ECOLOGY AND FLORA OF
QATAR

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QATAR



TO MY PARENTS

AND MY WIFE



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FOREWORD

One of the basic rôles of any university is to conduct research—research by which the academic community manifests its societal commitment to assist the people it serves to know more about themselves, and their environment. Such knowledge places man in a better position to understand his relationship to that environment, and to command and control wisely his use of identified resources within it.

The work presented here is a model of societal commitment, and a reflection of the kind of thinking which places science at the service of the community. It is an application of the principle of environmental research, a scientific principle which is fundamental to the basic concept of the University of Qatar. Though it is commmonplace in advanced countries to have scientific literature of this kind already available, no similar work has been done in Qatar. Thus Professor Dr Batanouny has performed a much needed survey—a unique and original catalogue of the flora of the peninsula of Qatar, with some identifications also of their ecological significance.

The author, Professor Dr Batanouny, has long been known for the quality of his academic standards and the seriousness which he gives to his work. But he is not merely a careful scientist; he is also a man with many personal qualities which are interwoven with his scholarship. He is persevering, dedicated, hard-working, and willing to tolerate unusual climatic conditions in pursuit of his goals. Without these qualities this book would not have been undertaken or completed. Yet the book itself must be viewed as a first stage of a long-range project which, it is hoped, will one day lead to determination of important economic and chemical uses for some of the plants identified and described.

The Scientific Research Centre was established at the University of Qatar to play a rôle in promoting research and in applying the findings of such research, and publication of Professor Dr Batanouny's work is one piece of evidence of this research activity. This vital approach to research shows that it does not matter how old or young an institution is, but rather, how valuable. In the face of such dedication and genuine productivity, the University must happily respond by further commitment to the Centre and its research activities.

May God Almighty guide our steps and let us see for ourselves that knowledge, research and application, fruits of earlier dreams, will lead the way to a better future for man.

PROFESSOR DR MOHAMED IBRAHIM KAZEM
President, University of Qatar

INTRODUCTION

The flora and vegetation of the countries of the Arabian peninsula are not yet well explored. Moreover, ecological information is fragmentary. Qatar is no exception. In view of this fact, the idea of writing this book was conceived to fill a gap in our knowledge of the ecology and flora of Qatar.

In order to put this idea into action, a programme for intensified field work was worked out. More than seventy field trips, including four trips with helicopters provided by the Ministry of Defence, were carried out. The information and descriptions given in this book are based on observations and plant specimens collected during the period from September 1978 to April 1980.

The book comprises two parts: the first of which deals with the ecological features of Qatar. The landforms of Qatar, the prevailing climatic conditions, soils and water resources and their effects on the plant life are given. A concise description of the vegetation and the widespread plant communities is presented. This part offers a framework for future detailed studies.

The second part deals with the flora of Qatar. The outcome of the collection is 301 species in 207 genera and 55 families. In 1975, Obeid reported on the vegetation of Qatar and listed 213 species, while Boulos (1978) gave a list of 260 species based on his collections and those of Obeid. An interesting collection by C. Wilcox from Qatar in 1971 has been inspected in the Herbarium, Royal Botanic Gardens, Kew.

For the arrangement of families, the system of Engler was adopted. Due to their limited number, the genera and species are arranged alphabetically. Concise description of families, genera and species is given, as well as the literature pertinent to the floras of the Middle Eastern countries. Habitat features of diagnostic importance, flowering time and local names when available are given for the different species. Keys for genera and species are presented. Coloured photographs, mostly in the field, for as many species as possible, are produced. Also, thirteen hand-painted coloured plates for some common species are given. It has been felt that illustrations are just as important, if not sometimes even more important, than mere description of parts for the identification of plants.

For further facilitation in handling the book by Arab scholars, an index of Latin–local and local–Latin names of the plants is added. Furthermore, a glossary of botanic terms with Arabic translation and explanations is appended. For this glossary, the glossary appended for Magihid's *Flora of Saudi Arabia* was lavishly utilized.

It is my earnest hope that this book will be of help to students and scientists engaged in ecological, botanical, agricultural research and in allied studies. Due to the spectacular development of the oil industry in Qatar, it seems imperative to develop other resources. Such a development would need the assessment of those resources; the plant resources are of particular importance.

Doha, Qatar: April 1981 K. H. BATANOUNY

ACKNOWLEDGEMENTS

This book could not have been written without the help of many people. Before all, I owe a debt of gratitude to my beloved parents who contributed a lot to my life. Also, I would like to express my sincere gratitude to all those who have in one way or another taught, coached, guided, encouraged, and most important, corrected me in some 40 years of education and learning. My sincere appreciation is also for the Bedouins in the deserts of Egypt, Iraq, Saudi Arabia and Qatar, from whom I learned, during my several trips in those countries, more than anyone expects.

My professors who introduced me to Plant Ecology and Floristic studies influenced me to a great extent, an influence for which I cannot be grateful enough. I cannot mention them all by name, but it is impossible to forget the profound influence of Professor A. M. Migahid, Professor A. A. Abdel Rahman, Professor M. Kassas and the late Professor Vivi Täckholm.

Professor M. I. Kazem, President of Qatar University, through his interest in the work, helped me in every conceivable manner. In fact, without his encouraging me and providing me with all facilities to carry out this work, this book would not have appeared. To him, I wish to express my deepest gratitude and appreciation.

My appreciation is also extended to all my coleagues in Qatar University, in particular Professor M. O. Abdel Rahman, Director of the Scientific and Applied Research Centre. His interest and encouragement pushed me to complete the study. Professor M. A. Bassiouni, Professor of Geology revised the part on the Geology of Qatar written by Dr M. A. Yehia; my thanks to them for their effort.

My colleagues in Cairo University have been helpful to me during this work. Professor M. N. El-Hadidi provided me with all the facilities of the Herbarium of Cairo University and checked the determination of my collection of *Zygophyllaceae* and *Euphorbiacaea*.

During the study of my collections in the Herbarium of the Royal Botanic Gardens, Kew, I received every possible help from Mr P. S. Green, Keeper of the Herbarium and his staff. Among my colleagues in the Herbarium who kindly determined some speciemens are Mr Matthews (*Caryophyllaceae*), Mr C. Jeffry (*Compositae*); Mr G. P. Lewis (*Leguminosae*), Dr F. Davis (*Compositae*), Miss S. Carter (*Euphorbiaceae*) and Mr T. A. Cope (*Graminae*).

From Qatar University, I received a lot of facilities. I acknowledge the help of Mr Ebrahim Al-Noaimi, Mr Moosa Zainal, Mr Salman Abdul Amir Dagher, Mr M. El-Hitmi and Mr. M. Al-Malki.

Thanks are due to the technicians in the Botany Department, particularly Mr A. M. Abu Sitta, who helped in collection, pressing and mounting of specimens.

The continuous assistance of the colleagues in the Teaching Technology Department is greatly appreciated.

Without the help and the work of the drivers, often under harsh conditions, this study would not have been accomplished. They were helpful in giving the vernacular names of plants.

My thanks are due to Mrs Lynda Mills for efficiently carrying out the typing of sometimes indecipherable manuscript and Mrs Roma Cozens for completing the task. Appreciation is also extended to Mrs Y. Walton for her assistance, particularly in photocopying the typed manuscript.

Sheikh Hassan bin Mohammed Al Thani was generous in arranging some trips to Al-Wabrah, a *rodah* in Central Qatar where he has a farm. From the *rodah*, I collected many plants which were not recorded in other parts of Qatar. To him, I wish to express my sincere thanks.

The Ministry of Defence provided me with helicopters for four trips during which the country was surveyed. The pilots were very helpful and this resulted in my being well acquainted with the landforms and vegetation of Qatar. To them I extend my deep gratitude.

I wish to thank Mr O. Al-Kawari, Director of Civil Aviation, for supplying me with climatological data of Doha airport.

Engineer I. Harhash, hydrologist in the Ministry of Electricity and Water, was helpful enough to supply me with hydrometeorological data of several stations in Qatar. I wish to express my sincere thanks to him.

Finally, I wish to express my heartfelt thanks to my wife for her unrelenting support and for her patience, understanding, tolerance and valuable assistance.

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PART ONE
ECOLOGY

GEOGRAPHY

Qatar occupies a peninsula which projects, like a splayed thumb or the ventral view of the right-hand palm, due north from the Arabian shore into the Gulf (Figs 1 and 2). Like most of the other Gulf states, Qatar is small in size and population. The peninsula of Qatar occupies about 10,600 km^2. The north–south axis is almost 180 km in length, and the east–west width at its widest point in the central area is 85 km.

There are some small offshore islands (Plate 1a), all uninhabited except Halul. North of Dukhan there are Hwar (an Arabic word denoting a young camel, due to its outline resembling the young camel beside his mother), and Abrouq. To the extreme north of the peninsula lies Rakan island, opposite Ruwais. A'aliyah and Safliyah are two small islands north-east of Doha, while Bashiriyah is opposite Umm Said. Al-As Hat lies to the south, opposite Khor Al-Odeid, and Shara'ou lies to the east. Halul island, an important oil storage centre, is located at a greater distance from the peninsula (52°50′E) and covers 11·7 km^2.

The southern landward frontiers of the peninsula of Qatar lie with the Kingdom of Saudi Arabia to the west and the State of Abu Dhabi (United Arab Emirates) to the east.

The peninsula of Qatar lies between 50°45′ and 51°40′E longitude and 24°40′ and 26°10′ latitude.

TOPOGRAPHY

The surface of Qatar peninsula is of low to moderate relief. The peninsula has a slightly undulating surface with scattered depressions (Plate 1b). The southern part of the country is moderately rough; the monotony of the flat eroded landscape is broken by mesa-type hills (Plate 1c) and large barchans (Plate 1d). To the north, the terrain is gently rolling with shallow, superficial depressions (Plate 2a).

The highest elevation in the peninsula—103 m above sea level—is located in southern Qatar, 20 km north of Suada Nathil (51°3′E, 24°43′N). On the other hand, the lowest part of the peninsula—at a level of 6 m below sea level—lies in a sabkha, 15 km south-east of Dukhan (50°50′E, 25°20′N). These figures show that the available relief does not exceed 109 m (Beheiri & Al-Farra, 1977).

The parts of the peninsula with elevations of 50 m and more above sea level are of limited area and lie in the south-western quarter of the peninsula (south of 25°20′N latitude and west of 51°15′E longitude). The area of land above 70 m is about 80 km^2, while that of land above 80 m is about 10 km^2. The major part of the peninsula is less than 40 m above sea level.

Sabkha (inland or coastal saline flats) occur in various parts of the peninsula and lie at a

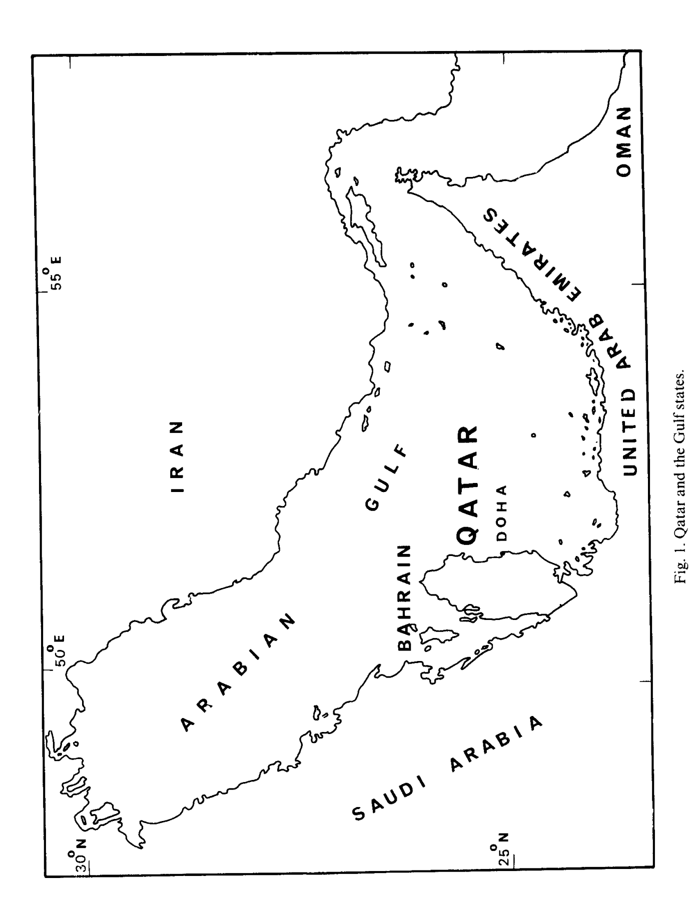


Fig. 1. Qatar and the Gulf states.

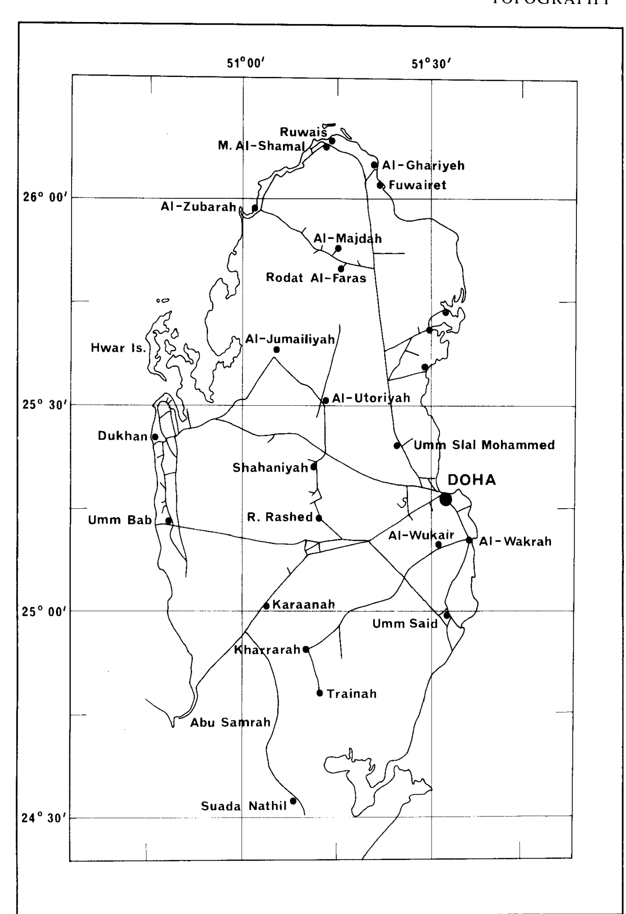


Fig. 2. Map of Qatar.

level less than 5 m above sea level. The most extensive sabkha is that along the eastern coast to the south of Umm Said. Areas below sea level are represented by three large patches, *viz.*: the area east of Dukhan, which is the largest area below sea level (about 60 km^2), north-east of Khor Al-Odeid (about 25 km^2) and north-east of Umm Said (about 10 km^2). These figures show that the area of land below sea level in the peninsula is larger than the area of land at 70 m or more above sea level.

As regards the local topography, the difference in level rarely exceeds a few metres. However, there are two areas in Qatar where the local relief exhibits considerable variation in comparison with the rest of the peninsula. In the south-eastern part of the country, the difference between the level of the tops of the mobile barchans and the level of the gravelly plain exceeds 40 m. Jabal Dukhan rises more than 50 m above the level of the sabkhas lying to the east.

Because of the gentle relief, no pronounced drainage system has developed. The numerous superficial depressions act as individual catchment areas receiving runoff water through shallow and poorly developed water runnels. Incised dry water washes are observed near the relatively pronounced hills in the western part of the country. The modest relief of the peninsula gives the mushroom-shape eroded rocks their significance as an important feature along the western sector of the Doha–Dukhan road.

LANDFORMS IN QATAR

Despite the modesty of the available relief of Qatar, the physiognomy of the landscape exhibits well-defined landforms. This could be evinced from the rich topographical terms used by the Qataris in the colloquial Arabic dialect. Some of these terms are used by natives of the Arabian peninsula, particularly in the Gulf states. These terms describe the various landforms. Names of places usually denote the particular feature of the place. These names are often prefixed by *Umm* or *Abu* (meaning mother or father, i.e. the possessor of some natural feature, animal, plant or tribal incident).

A list of the commonly used terms is given below:

Barr Qatar = the stone desert, the central limestone plateau of Qatar.

Rodah (*pl. rodat or riyad*) = depressions into which soil has accumulated and are usually harbouring denser vegetation compared to the surrounding barren, elevated land, e.g. *Rodat Al-Faras* (*Al-Faras* = the mare), *Rodat Rashid* (*Rashid* = name of a tribe), *Al-Wabrah*.

Jiri (*pl. jiryan*) = a depression where water accumulates and trees grow, e.g. *Jiri Abu Ghanem* near Jamiliyah.

Manqa' (*manga*) = a low land where storm water accumulates; it may be swampy.

Hazm (*pl. hozoom*) = the slight rises between depressions; there are several types of *hozoom*.

Agwa' (*sing. gaa or quaa*) = low land as regards local topography, e.g. *Agwa Al-Himdh*.

Hdiba = a low rocky mound.

Hassa = corase pebbles and gravel.
Mistah = the bare, eroded hard pan surrounding the shallow depressions.
Jabal = in literary Arabic means 'mountain', but in Qatar denotes the separate hills, e.g. *Jabal Dukhan*.
Gehab (*Al-Aghab*) = white beds or layers in the ground or hills, e.g. *Umm Al-Gehab* (there are numerous places in Qatar with this name).
Agwab (*sing. wagb or wagbah*) = depression, e.g. *Awgab As Salam* (*As Salam* is *Acacia ehrenbergiana*, *Al Wagbah* is a low-lying *rodah* west of Doha).
Sabkha = saline coastal or inland playas.
Tu's (*pl. te'us*) = isolated barchan sand dunes.
Kheyt (*pl. kheyut, dim. khuweyit*) = isolated barchan sand dunes.
Nigyan = extensive dune field arising from the coalescence of barchans.
Dahl (*pl. dehlan or dohoul*) = a deep cavern (Plate 2b).
Nabk = a phytogenic mound formed around the body of *Ziziphus nummularia* (*Sidr*) in the *rodat*.

The shape, soil, topography, geological structure and petrographic composition of the landscape are factors affecting the life of plants, as well as other living organisms. There is a continuous interaction between the plants and their environment. The special environment in which a particular plant or plant community grows is defined as a habitat or biotope. For a geographer, habitats are landforms such as wadis, slopes, escarpments, rifts, etc. The occurrence of these landforms is attributed to various agents; also different processes are involved. Through their effects on the environment, which include the integration of factors such as soil, water, air, light, radiation, temperature, wind and humidity, these landforms affect the distribution and growth of plants. Hence, it seems better to discern the landforms on bases related to the plant life, e.g. geomorphological features, the salient soil characteristics, water resources, agents of erosion and above all the type of plant growth. The differentiated units may be termed phyto-ecogeomorphological systems.

The main phyto-ecogeomorphological systems in the Qatar peninsula include rocky and conglomerate hamada (Arabic meaning 'the unfruitful'), mesas and buttes, rocky ridges, depressions (*rodat* and *manga*), wadis and runnels, sand formations and sabkhas.

ROCKY AND CONGLOMERATE HAMADAS

The major area of the peninsula is occupied by this type of landform. The local names *hazm* and *mistah* may describe them well. A *hazm* denotes the slightly elevated land covered by stones and gravel, it is exemplified by the piece of land separating two depressions. On the other hand, *mistah* means a flat land covered with stones and gravel; while the *hazm* is slight and very gently sloping, the *mistah* has not even a distinguishing incline.

In these systems, the ground surface is covered with stone fragments which are the produce of *in situ* weathering. Finer particles produced by weathering and decomposition of the bedrock are carried away by the deflationary action of wind; the coarser conglomerates and stones that are too heavy to be moved by the wind remaining to form the desert

pavement. Little soil occurs and only in the interstices between the stones of the pavement.

The vegetation of hamadas (*hozoom* and *masatih*) is very poor. Three of the common plants of Qatar grow in the interstices between the stones of the pavement where soil has accumulated, namely *Zygophyllum quatarense* (*Harm*), *Acacia tortilis* (*Samr*) and *Lycium shawii* (*Awsaj*). A considerable growth of lichens is usually observed on the stones in the *hozoom*, particularly in northern Qatar (Plate 2c).

ROCKY RIDGES

Ridges of considerable elevation are confined to the south-west of the country. The main rocky massive ridge extends parallel to the western coast till the Doha–Abu Samrah road, then turns slightly to the east and ends to the north of latitude 24°30′N. North and south-west of Kharrarah there are conspicuous rocky elevations.

The Jabal Dukhan is a rocky limestone ridge having strongly marked depressions with considerable aeolian sand accumulations. Compact conglomerates cover the flattened tops of the ridges near Dukhan, south of Umm Bab (Plate 2d), as well as those of the rocky elevations around Kharrarah. These conglomerates form another type of desert pavement different from that formed in the hamadas. The desert pavement covering the Miocene formation is not created *in situ*. The pavement stones are resistant to erosion and this pavement is similar to that of the regs (Arabic, meaning 'becoming little', 'small'). This pavement overlies limestone or chalk ridges, which are easily disintegrated and the overlying stones move down, mixed with the products of weathering (Plate 1c). Usually, this leads to the appearance of mesas and buttes. Among the resultant features are the rocky mushroom-like outcroppings, a characteristic feature of the landscape in south-west Qatar.

The plant life is very poor. In the Dukhan ridge the plant life is confined to the sand accumulations in depressions. A community dominated by *Panicum turgidum* (*Thumam*) abounds on the deep sand accumulations, while *Zygophyllum quatarense* (*Harm*) dominates the plant growth on shallow deposits or slightly saline soil on the scarp. In contrast to the hamadas, where plants grow in the interstices between stones, vegetation appears on the tops of the Miocene ridges only in shallow depressions or runnels. The rock detritus, when mixed with the conglomerates around the elevated hillocks, may support a scanty growth of *Z. quatarense*. The runnels and depressions in these ridges constitute different phyto-ecogeomorphological systems which will be dealt with in the following pages.

DEPRESSIONS

The Qatar landscape is stippled by approximately eight hundred and fifty surface depressions, which lie below the surrounding land surface at a depth ranging from a few metres to as much as 20 m. These depressions are usually called *rodat* (sing. *rodah*) by the Qataris (Plate 11). Another type of shallow depression, usually lineated and different in origin from the *rodat*, is the closed-in depression locally known as *manga*. These

depressions lie just a few centimetres below the surrounding land surface. The *rodah* and the *manga* differ as regards water revenue, soil characteristics and plant growth.

THE RODAT

These are the wide large depressions ranging from a few hundred metres to two to three kilometres in diameter. Some depressions are almost circular; however, lineated depressions do occur. The depressions do not lie at the same level, and when they are full of water following storms, one depression may drain its water into the next lower one through connecting runnels which are at levels higher than the base of the depressions themselves.

Cavalier (1970) claimed these depressions to be surface expression of collapse structure at depth. He distinguishes between normal collapse structure of northern and central Qatar and the more crater-like depressions of southern Qatar; the latter being directly associated with anticlinical structures. Other investigators (UNDP/FAO, 1977) argue for an identical origin for all depressions, i.e. by subsurface solution of evaporites and subsequent collapse. Those in northern Qatar are older and have undergone considerably more erosion and now appear only as shallow undulations in a mature landscape that is essentially devoid of sand cover. These depressions give rise to a gently rolling terrain with often only low ridges separating adjacent depressions. The more circular, crater-like depressions of southern Qatar have not undergone such progressive erosion because of comparatively recent cover by mobile sand dunes.

Because of the local topographical differences between the low-lying depressions and the slightly elevated ridges (*hozoom*), the depressions receive runoff water in addition to water-borne and/or wind-blown materials. Sheet runoff occurs with water running on the surface of gently eroded slopes of the ridges.

The depressions (*Rodat*) are more numerous in the north than in the south of Qatar. To the north and in the centre the depressions have deep, fine-textured deposits (Plate 3b) while the southern depressions have shallow, coarser surface deposits. However, the former type occur in some parts as far as the south of Kharrarah, near Trainah.

The depressions harbour denser vegetation compared to the surrounding elevated land; hence they get the Arabic name *rodat* (Plate 32). The dominant plant species that gives the vegetation its physiognomy varies among the different depressions. The kind of plant gives a reasonable indication of the water revenue and the soil characteristics in these depressions. The agent of deposition and erosion, through its effect on the soil characteristics, may be evinced from the kind of plant which is dominant. Where the deposits are deep, fine-textured and transported mainly by water, the dominant plant is *Ziziphus nummularia* (*Sidr*). This species is capable of forming huge phytogenic mounds by trapping the water-borne and the wind-blown material around its body. The mound body (known locally as *nabk*) is formed of fine-textured sediments having high water retention capacity (Plate 3b).

In some depressions, usually in northern and central Qatar, the water-borne, fine-textured deposits are shallower than in depressions dominated by *Ziziphus*. In such a case, the tree or shrub layer is not well represented, but the dominant plant is *Cymbopogon parkeri* (*Skhabar*) (Plate 3c). It is a palatable grass which flourishes in spring.

On the other hand, in depressions with shallow surface deposits and bedrock usually outcropping on the surface, *Ziziphus* disappears and is replaced by *Acacia tortilis* (*Samr*).

Where the sediments are fine-textured, compact and mainly water transported, *A. ehrenbergiana* (*Salam*) dominates. Both species of *Acacia* do occur together in the same depression.

It is to be noted that *Lycium shawii* (*Awsaj*) is a common associate of all the above-mentioned dominants. This spiny shrub occurs in nearly all depressions.

Compared to the northern depressions supporting the grass *Cymbopogon parkeri*, the southern depressions with sand deposits exhibit two distinct habitats. In one of these habitats, sand may be deposited by wind and has a coarse texture, and the plant growth is dominated by *Panicum turgidum* (*Thuman*) (Plate 3d). In the second kind of habitat, depressions with fine sand deposited by water have a plant cover dominated by *Pennisetum divisum*. *Acacia tortilis* usually grows along the borders of depressions supporting *Panicum turgidum*, while *Acacia ehrenbergiana* grows in depressions where *Pennisetum* abounds.

In addition to the difference in the dominant plants in the various depressions, the plants exhibit a particular distribution within each depression depending on the soil characteristics and water revenue. In any one depression, the soil (surface deposits) is usually deeper in its centre and becomes thinner and thinner towards the margin. No doubt the water revenue of the lower central parts having deeper soil is greater than the marginal parts adjacent to the elevated ridges. In one of the depressions in north Qatar, it has been observed that the dominant perennial grass *Cymbopogon parkeri* disappears along the margins. Only ephemeral growth extends along the borders of the depressions. Within the ephemeral growth covering the whole depression, one can notice variation in the kind of species growing in the centre and the kinds growing along the margins. The latter species are represented mainly by succulent ephemerals such as *Zygophyllum simplex* and *Aizoon canariense* (*Chafnah*). Species present in the central and the marginal parts of the depressions exhibit stunted growth in the latter parts, e.g. *Stipa capensis* (*Samaa'h*) and *Trigonella stellata* (*Nafal*).

Agriculture in Qatar is confined to these depressions, depending on underground water supplies. The number of farms varies from year to year, perhaps due to deterioration of water quantity and quality. In 1976 there were 270 farms of an average area of 14·7 ha with a total aggregate irrigated area of 1975 ha or 0·17% of the land area of the country.

It is noteworthy that the total area of these depressions, as estimated on the bases of soil types (UNDP/FAO, 1973), amounts to 27,650 ha or 2·44% of the land area of Qatar.

SHALLOW DEPRESSIONS

Shallow depressions and furrows, a few centimetres lower than the surrounding land, occur on the rocky plateau. These depressions receive runoff water and sediment to a degree lesser than the *rodat*. These depressions originate through various erosional processes or may sometimes be man-made, particularly along roads.

The kind of species growing in these depressions depends on the soil characteristics. Where the thin deposits are transported mainly by water, *Francoeuria crispa* (*Githgath* or *Yithyath*) appears. On the other hand, where the deposits are coarse-textured and wind-blown, the dominant plant is *Zygophyllum quatarense* (*Harm*). On the tops of the Miocene ridges and hillocks in south-west Qatar, the gravel-strewn pavement exhibits shallow depressions with a thin veneer of sand supporting *Z. quatarense* (Plate 4a).

Usually this plant accumulates low (10–20 cm) sand mounds around its body. In more or less flat, shallow depressions, a sparse perennial growth is represented by a few scattered *Acacia tortilis* shrubs. In spring, after heavy rains, a dense cover of ephemeral plant cover appears (Plate 4b).

It is interesting to know that in some protected *rodat*, trees such as *Ziziphus nummularia* (Plate 4c) and *Acacia tortilis* (Plate 4d) attain considerable heights.

WADIS AND RUNNELS

Wadis draining wide catchment areas with well-developed tributaries and ravines and having deep main water courses are not represented in Qatar. However, in the hilly country to the south of Qatar, the presence of massive ridges and elevations with low-lying long runnels create what the natives call a wadi. In addition to these wadis there are different types of runnels, the length and width of which vary and result in a widely different type.

WADIS

The relatively deep and long runnels called wadis occur mainly in south-west Qatar. The geomorphological systems named wadis in Qatar are: Wadi Galal, Wadi Dhiab and Wadi Al-Jah. The accumulated water and sediment are concentrated in the lower parts of the so-called wadis. The main plant growth in these wadis is dominated by *Pennisetum divisum* with shrubs of *Acacia ehrenbergiana* (*Salam*) and *Lycium shawii* (*Awsaj*) (Plate 5a, b). In some parts of the wadi, where wind plays a role in the deposition of sediment, *Leptadenia pyrotechnica* (*Markh*) becomes an important associate (Plate 5c). The plant cover is relatively high in these wadis, reaching 40% on the average.

A noticeable feature in these wadis is the presence of fine sediments which crack after drying or have rolled solid crusts when thin (Plate 5d). Usually, the parts covered by thick layers of silt and clay are sterile. In some parts of the wadi, the flood water after heavy rainfall removes the fine sediments, leaving a coarse-textured bed with poor plant cover.

LONG RUNNELS

These types of long runnels are recognizable in different geographical locations in Qatar. One type is that dissecting the desert pavement on the tops of the Miocene ridges in south-west Qatar; the second is that lying at low levels between the elevated hamada ridges (*hozoom*); while the third type is represented by runnels draining the plateau and having their downstreams towards the western coast of Qatar. In the first type, the course of the runnel is delimited by the slightly elevated erosion-resistant desert pavement (Plate 6a). The runnel bed is covered by stones and gravel, with sandy deposits (Plate 6b). The plants accumulate the trapped fine sediments around their bodies. The dominant plant is *Chrysopogon aucheri* (*Haltaa*). The second type meanders among the elevated *hozoom* and its bed is covered by angular stone fragments. The stone cover decreases as the runnel bed widens and the slop decreases. Such variation in the character of the deposits results in a difference in the plant cover. The common plants in these runnels include *Chrysopogon*

aucheri, *Teucrium polium* (*Jaa'd*, *Ya'ad*) and *Glossonema edule* (*Garawah*, *Yarawah*). The runnels crossing the plateau and draining towards the western shore (Plate 6c) support a plant cover dominated by *Sporobolus arabicus* in wide parts with gentle slopes and by *Limonium axillare* (*Qataf*) in narrow parts. The main course of the runnel is covered by stones and rock detritus.

SHORT RUNNELS

The gentle slopes of the ridges are dissected by short, narrow runnels. The beds of these runnels are covered by stone fragments and gravel with a thin veneer of coarse sand between the fragments. These runnels are usually devoid of perennial plant cover. The plant cover is represented by *Glossonema edule* (Plate 6d), *Zygophyllum simplex* and *Anastatica hierochuntica* (*Kaff Maryam*).

RUNNELS CUTTING BACKWARDS

The occurrence of this type of runnel is confined to the Miocene ridges in south and south-west Qatar. These runnels result from the erosion and disintegration of the limestone ridges. These processes result in deep runnels having a 2–3 m configuration. The upstream of the runnel ends in an almost vertical cliff with a slightly protruding top (Plates 7a, b). The main channel of the runnel dilates as it proceeds away from the ridge and is usually filled with disintegrated stones, gravel and fine deposits. Where deposits consist of fine water-borne material, the dominant plants are represented by *Acacia ehrenbergiana* and *Pennisetum divisum* (Plate 7a). On the other hand, where the main channel is filled with wind-blown, coarse-textured sediments, the dominant plant is *Panicum turgidum* (*Thumam*) (Plate 7b).

SABKHAS

The coastline of Qatar is gently emergent and presents an uneven outline with numerous inlets, islands, reefs, capes and bays and extensive areas of sabkhas.

Sabkha is an Arabic term denoting inland or coastal saline flats or playas with fine silt and calcareous sands. Coastal sabkhas are widespread along the coastal margins of Qatar, especially along the eastern coast to the south of Umm Said. Extensive inland sabkhas abound to the east of the Dukhan ridge and in southern Qatar. Sabkhas below sea level occupy a considerable area in Qatar, reaching 95 km^2.

Apart from the high salt content of the soil in sabkhas, the water table is near soil surface. In some parts, the sabkha may be inundated by sea water during high tide. Many factors are involved in the distribution of halophytes growing in these sabkhas, mainly: salinity; height above sea level and inundation by high tide; distance from the sea shore; and the texture of the deposits.

One of the remarkable features of plant growth along the coasts of Qatar is the occurrence of mangrove vegetation represented by *Avicennia marina* (*Girm*) (Plate 7c). A dense population of *Avicennia* occurs in areas covered by sea water opposite Dhahkira, along the eastern coast of Qatar. The growth of *Avicennia* in this particular part of the

coast of Qatar is of interest. It has been observed that the growth of *A. marina* usually occurs in shallow sea water where fine sediment is transported by torrential floods pouring their water through wadis into the sea. The sediment is usually rich in organic matter content and this results in anaerobic conditions. In the locality occupied by *Avicennia* in Qatar, the sediment has been transported by long narrow runnels. Sediments are protected by a protuberance partially separating the area occupied by mangrove growth from the open water in the Gulf. Along the shores in this particular area, there are different halophytic plant communities. *Arthrocnemum glaucum* (*Shnan*) grows profusely on saline flats with fine-textured soil and with shallow water table (Plate 7d). Communities dominated by *Juncus rigidus* or *Aeluropus lagopoides* (*Ikrish*) occur in salines of this area.

Sabkhas south of Umm Said are encroached on by the mobile dunes (Plate 8a). Hence, the plant life is confined to low circular parts between the cusps of the coalesced dunes as well as coastal strips which are not covered by the sand dunes. The bodies of the dunes support no plant life.

Around Khor Al-Odeid, the parts covered by the mobile dunes are sterile and support no plants. Between the sand bodies, at a low level, a sparse plant cover with scattered individual plants of *Zygophyllum* and *Limonium axillare* (*Qataf*) is observed. Considerable areas are covered by a thin white salt crust or gypsum crystals (Plates 8b, c).

The sabkha east of the Dukhan ridge is covered with brine and the vegetation is restricted to the margins where the salts are diluted with runoff water from adjacent elevated areas, and the ground is above sea level. Strips of vegetation dominated by *Halocnemum strobiolaceum* surround the low-lying sabkha (Plate 8d).

The sabkha along the western shore from Umm Bab southwards is covered with calcareous sandy deposits. The common halophytic plant communities are dominated by the succulent halophyte *Halopeplis perfoliata* (*Khorreiz*) (Plate 9a) or the salt-secreting halophyte *Limonium axillare* (Plate 9b). Wild palm, *Phoenix dactylifera*, grows along the shores at Umm Bab (Plate 9c). Some halophytes grow associated with the wild palms and include *Limonium axillare*, *Sporobolus arabicus*, *Cressa cretica* (*Nediwah*) and *Suaeda vermiculata*. The latter species dominates a plant community along the shore opposite Abu Samra. This plant accumulates fine sediments around its body (Plate 9d). *S. vermiculata* is grazed by camels. It is interesting to know that the halophytic grass *Halopyrum mucronatum* dominates a community in the south-eastern corner of Qatar near Abu Samra. The plant forms sizeable phytogenic mounds of calcareous sand.

In some parts near Abu Samra, artificially (man-made) hollows result in the accumulation of water (from groundwater and/or runoff water). Such a change in the environmental conditions causes the appearance of a community dominated by *Cyperus laevigatus* (Plate 10a).

In the sabkhas to the north-west of Qatar, *Sporobolus arabicus*, *Aeluropus lagopoides* and *Halocnemum strobiolaceum* dominate different plant communities.

It is noteworthy that the root parasite *Cistanche phelypaea* (*Dhonoon*) grows in the sabkhas of Qatar, parasitizing on *Limonium axillare*, *Arthrocnemum glaucum* as well as other halophytes.

Soil studies in Qatar (UNDP/FAO, 1973) show that the sabkhas comprise two different types occupying a total area of 70, 124 ha or 6·06% of the country's area. It seems that dividing the sabkhas into only two types is an overgeneralization.

SAND FORMATIONS

Wind plays a great role in shaping the surface of the country. The prevailing wind is N.NW, NW and is known locally as *shamal*.

A considerable area of the Qatar peninsula is covered by aeolian sands which overlie all other deposits. These sand deposits are of various shapes and occur mainly in the southern half of the country and secondarily along the north-eastern coastline. These sands have two different origins. The north-east deposits are essentially calcareous and similar in constitution to the marine calcareous sands of the shoreline and marine pseudo-oolitic limestones to which they are related. The sands of southern Qatar are of silico-calcareous type, with worn, rounded grains. In the words of Cavalier (1970) the origin of the material is, without doubt, from the western coast towards Qatar inland; the aeolian sands derive from the coastal marine sands which are periodically reworked when the *shamal* (prevailing N.NW, NW winds) blows. The dry material is removed and rapidly reworked by repeated impact on the outcrops which themselves undergo deflation. Small calcareous or siliceous splinters from the outcrops are also swept away and reworked. Apart from the rather infrequent sandstorms, sand grains advance in successive leaps, following essentially favourable trends which lead them to pre-existing accumulations, where they temporarily take the place of the preceding ones, as this accumulation is swept along towards another.

The aeolian sands occur in the form of thin sheets, small hummock dunes, barchan dunes which may be modified into various shapes, or the large dune fields (*Nijyan* or *Nigyan Qatar*). Each of these forms has its particular features and may or may not harbour plant cover.

SURFACE SANDS

These are uneven and quite thin sheets. Where these sands are trapped by any natural obstacle there is ample room for the growth of poor plant cover. On the rocky hamada in southern Qatar, the deposition of these surface sands in the crevices between the rocks results in the appearance of sparse growth of *Zygophyllum quatarense* (*Harm*) or *Stipagrostis plumosa*.

SAND DEPOSITS IN DEPRESSIONS

These are deeper than the former type of sand deposits. These abound mainly in depressions, wadis and runnels. They support relatively denser plant cover than the elevated surrounding land. The kind of species depends on the depth and texture of the sediments. In southern Qatar, communities dominated by *Panicum turgidum* (*Thuman*) (Plate 10b) and *Hammada elegans* (*Rimth*) (Plate 10c) are examples of plant communities inhabiting these habitats.

BARCHANS

These are crescentic sand dunes (Plate 1d) with the apex of the crescent pointing at slightly

different angles from N.NW to NW, which is the *shamal* direction. The dunes show a gradual slope on the windward side and a steep one on the leeward side. Each dune has two, frequently unequal, cusps lying parallel to the wind trend. The height of the dune ranges from 30 to 40 m, distance between the two arms ranges from 150 to 350 m.

The barchans are quite numerous to the south-east, between Hazm Berich and the dune field of the *Nijyan* and to the south between the Tuwar al Huraiki and Sauda Nathil. Some barchans are isolated in other parts of southern Qatar. This type of dune is known locally as *te'us* (sing. *tu's*).

Barchans are devoid of plant cover. However, individuals of *Cyperus conglomeratus* (*Rasha*) grow on the sides of the barchan which have shallow sand deposits (Plate 10d).

Due to their mobility and the almost air-dry upper layers, barchans do not favour the growth of plants on their bodies.

Usually, these barchans occur on almost level land without significant undulations. Changes in the surface of the land or the moistening of the lower parts of the dune in the sabkha will lead to obvious changes in the normal shape of the barchan. Like the barchans, all these sand bodies are barren and support no vegetation.

DUNE FIELDS

Dune fields and broad deposits encountered to the south-east of Abu Samra, along the southern border, and south of Umm Said are known as *Nijyan*. The barchans constitute these dune fields by coalescing and losing their individuality.

Owing to the trend of the prevailing wind, a large part of the aeolian sands which cross the Qatar peninsula converges on *Nigyan Qatar*, hence on the Arabian Gulf. This explains the high quartz content of the marine coastal sands of the region south of Umm Said.

The bodies of the coalesced dunes are barren. Areas not covered with sand in the concavities of the coalesced dunes support poor vegetation. Usually, these concavities lie at a low level near to the saline water table. Hence, halophytic plants grow in such habitats.

SOILS

Reconnaissance soil surveys were undertaken in Qatar (UNDP/FAO, 1973). As a result of these surveys, the soils in Qatar have been classified into four soil associations according to the topographical features, and eight soil series according to the soil texture. The results of the above-mentioned survey are given below:

Association (A). *Rodah soils* (*colluvium depression*)

Series A1: (23,000 ha). These depressions are filled with younger sediments which have been washed down from surrounding areas and include fine soil material such as calcareous loam to clay loam, overlying limestone boulders or limestone beds. The depths of these soils vary from as little as 30 cm to as much as 150 cm.

Series A2: (4,520 ha). The same but with calcareous sandy loam to sandy clay loam in texture and the surface is covered with wind-blown sand to a depth of 10–15 cm.

Association (B). *Sabkha deposits* (*highly saline depression soils*)

Series B1: (6,517 ha). The soils are normally found adjacent to the Gulf shores. They are characterized by a profile ranging from 30 to 150 cm deep. Texture ranges between calcareous sandy clay loam to clay loam with greyish subsoil as a result of anaerobic conditions due to the existing water table. Gypsum accumulations are found close to the soil surface on which a salt crust exists.

Series B2: (63,607 ha). The same, but with calcareous sand loam to loamy sand to sand, without gypsum accumulations or greyish subsoil.

Association (C). *Lithosol* (*rocky soils*)

Series C1: (958,072 ha). These are very shallow soils (10–30 cm deep) of calcareous sandy loam covered with rock fragments and overlying a similar layer mixed with rock fragments followed by a limestone bedrock. This lithosol is found mainly on plateaux.

Series C2: (62,925 h). These rocky hill outcrops are found in the south and centre of Qatar and are formed mainly of limestone.

Association (D). *Sandy soils*

Series D1: (4,775 ha). Wind-blown sandy soils which are characterized by sandy shallow to deep profiles (30–510 cm). Texture ranges from calcareous loamy coarse sand to coarse sand. This soil consists of a mixture of desert and marine sands.

Series D2: (31,392 ha). This is formed of white oolitic sand (pseudo-sand) of marine origin, usually found close to the Gulf shores. The soil is characterized by its deep profile (120 cm), consisting of white calcareous coarse sand mixed with broken snail shells.

The aforementioned series have been considered as soil mapping units and a soil map has been compiled for Qatar. However, more detailed studies are indispensable to elucidate the different soil types in Qatar. Acquaintance with the distribution of the different plant communities and their dominants would be of great help in the soil studies.

CLIMATE

Qatar lies within the vast desert belt extending from North Africa to Central Asia. Though the climatic conditions of some countries in this belt have been studied, climatological studies are still lacking in many parts of this belt. This is mainly attributable to the lack of adequate, long-term and reliable synoptic data up to the end of the last decade. This holds true in Qatar and the neighbouring Gulf states.

Since 1962, climatological data have been collected by the Department of Civil Aviation at Doha airport. Data of the last few years have been compiled in annual

reports. These data from Doha airport represent a fairly reasonable data base, with some records covering 17 years.

Although meterological data have been obtained at various sites in Qatar since 1958, the quality of data is uneven (Pike, 1978). Also, it has been claimed that rainfall records from the well-fields in different parts of the country are unreliable in certain periods (Pike *et al*., 1975).

During the course of the integrated water and land use project in the country (UNDP/FAO), some hydro-meteorological stations were established at various locations in Qatar. During the seventies—since 1972—some forty rain-gauges, including automatic recording rain-gauges, were installed in a country-wide network. Data obtained from these hydro-meteorological stations and rain-gauges are used in the present study.

RAINFALL

As in other parts of the arid zone, rainfall in Qatar is scanty. The average annual rainfall at Doha is 78·1 mm (17 years). Considering the rainfall of a growing season, i.e. September to August, the average rainfall (six growing seasons) ranges from 57·4 mm at Al-Kharrarah to 88·9 mm at Rodat Al-Faras (government farm in northern Qatar).

Rainfall in Qatar is confined to 8 months extending from October to May. The period from June to September is practically rainless. Showers in October and May are usually of low efficiency. This is attributable to the high evaporative power of the atmosphere and dry soil during these months. Showers in the early autumn months may have an indirect effect on some perennial plants flourishing at that time of the year, especially chenopods. This group of plants flower in autumn, e.g. *Hammada elegans* (*Rimth*), *Anabasis setifera* (*Sha'aran*) and *Seidlitzia rosmarinus* (*Shnan*). Rainfall in November, usually known locally as *wasmi* (*wasm* denotes a mark, i.e. the rainfall that wets the soil surface) is of paramount effect in the growth of truffles (*Faga'a'*). Considerable crop of the fruiting bodies of this fungus is expected when rain falls in November. Perhaps the high temperature in November together with water supply would be the favourable conditions resulting in the appearance of truffles. Later rainfall in winter months is not effective in this respect.

Records of rainfall at Doha (Tables 1 and 2) show that the rainiest month is January, with 19·8 mm on the average. The average monthly rainfall is 17 mm in February, 11·9 mm in April and 10·3 mm in December, while in the other rainy months it ranges from 1·3 mm in October to 7·3 mm in March.

An important characteristic of rainfall in Qatar, as in other arid areas, is its irregularity and variability in both time and space; hence it is extremely unpredictable. The temporal fluctuations of rainfall are evident from the data incorporated in Table 1 showing the monthly and annual rainfall at Doha over a period of 17 years. Thus, while the average annual rainfall is 78·1 mm, this figure fluctuates between 0·4 mm in 1962 and 302·8 mm in 1964.

Various methods can be used to measure the irregularity of rainfall. One common simple measure is the quotient of variation, which is the ratio of the maximum annual rainfall to the minimum. This quotient for Qatar at Doha is very high, reaching 757, whereas that of Bahrain is 11·6, that of Kuwait 8·9, and that of Dhahran (Saudi Arabia)

TABLE 1

Rainfall (mm) at Doha airport during 1962–78

YEAR	MONTH												
	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Year*
1962	–	–	0·2	0·2	–	–	–	–	–	–	–	–	0·4
1963	–	–	–	1·5	106·4	–	–	–	–	–	5·6	1·5	115·0
1964	93·1	38·8	13·0	2·5	–	–	–	–	–	–	–	155·4	302·8
1965	5·0	1·2	–	68·1	–	–	–	–	–	–	13·0	–	87·3
1966	–	40·2	–	3·4	–	–	–	–	–	–	–	–	43·9
1967	–	2·0	3·3	13·9	–	–	–	–	–	–	–	–	19·2
1968	–	40·4	–	27·8	–	–	–	–	–	–	–	–	68·2
1969	101·8	0·2	–	15·1	–	–	–	–	–	–	–	–	117·1
1970	10·7	–	1·5	–	–	–	–	–	–	–	–	–	12·2
1971	0·6	5·8	–	8·4	–	–	–	–	–	–	–	0·2	15·0
1972	1·8	6·7	57·7	9·6	–	–	–	–	–	–	1·0	7·9	84·7
1973	22·0	–	–	0·2	–	–	–	–	–	–	–	–	22·2
1974	5·8	23·4	16·7	1·7	0·2	–	–	–	–	–	–	4·1	51·9
1975	31·2	46·3	1·1	1·8	–	–	–	–	–	–	–	4·4	84·9
1976	25·2	53·9	23·1	40·3	–	–	–	–	–	5·4	45·5	–	193·4
1977	41·4	17·9	0·5	2·3	–	–	–	–	–	17·3	8·1	3·1	90·6
1978	–	12·8	1·0	5·9	–	–	Tr	–	–	–	Tr	Tr	19·7
Mean	19·8	17·0	7·3	11·9	6·2	–	Tr	–	–	1·3	4·3	10·3	78·1

Tr means Trace, i.e. the amount of rain which has fallen is not large enough to be measured (less than 0·1 mm).

16·6. Examination of the data of annual rainfall at Doha for a period of 17 years (Table 1 and Fig. 3) reveals that the number of years with rainfall below 25 mm represent 32·3% of the total number of years of record, while years with rainfall between 25 mm and 100 mm represent 41·2% and those with rainfall above 100 mm represent 23·5%. Annual rainfall of more than 120 mm is exceptional.

Irregularity is not only from year to year, but also there is a wide variation between the corresponding months of the different years (Table 1). During a period of 17 years, the average rainfall at Doha in January reached 19·8 mm, with a maximum of 101·8 mm in 1969, but in 6 years there was no rain at all during January. Also, in December, the rain amounted to 155·4 mm in 1964, but no rain fell in 9 years during the period of record. The same can be observed in the other rainy months of the year.

TABLE 2

Rainfall peculiarities at Doha airport for 17 years (1962–78)

MONTH	*Mean rainfall (mm)*	*Mean no. of rainy days (1 mm and more)*	*Maximum rainfall in a month (mm)*	*Maximum rainfall in 24 h (mm)*
January	19·8	1·8	101·8 (1969)	58·0 (1969)
February	17·0	2·1	53·9 (1976)	29·3 (1975)
March	7·3	1·1	57·7 (1972)	32·1 (1972)
April	11·9	1·5	68·1 (1965)	34·4 (1976)
May	5·9	0·2	106·4 (1963)	64·0 (1963)
June	0·0	–	–	–
July	Tr	–	–	–
August	0·0	–	–	–
September	0·0	–	–	–
October	1·3	0·1	17·3 (1977)	17·3 (1977)
November	4·3	0·2	13·0 (1965)	45·0 (1976)
December	10·3	0·8	155·4 (1964)	80·1 (1964)
Year	78·1	7·8	155·4 (1964)	80·1 (1964)

Tr, see Table 1.

The spatial variation of rainfall is evident from the annual rainfall at seven stations (1972–78) (Table 3). The rainfall during the growing season, i.e. from September to August, exhibits wide variation at the various stations. Trainah, in southern Qatar, received 100 mm in 1973/74; while Al-Kharrarah, about 15 km away, received 82 mm. During the same season Dukhan and Ruwais received 26·5 mm and 29 mm, respectively.

Spatial variations in rainfall become even more significant when the monthly data are considered (Table 4 and Fig. 4). In February 1974, Trainah received 84·0 mm, while Al-Kharrarah received only 34·0 mm. In the same month, rainfall was 26·9 mm at An-Nasraniyah, 23·4 mm at Doha, 19·6 mm at Rodat Al-Faras, 15 mm at Dukhan and only 7 mm at Ruwais. In January 1972, Rodal Al-Faras received 30·2 mm, while An-Nasraniyah received 14 mm, Dukhan received 3·8 mm, both received 1·8 mm and no rainfall was recorded in the other three stations, viz. Ruwais, Al-Kharrarah and Trainah. The phenomenon of temporal and spatial variability is clearly exhibited in Fig. 4 which shows the monthly rainfall in four stations during 7 years.

An outstanding case indicating the patchiness of rainfall in Qatar is evident from the records of rainfall in September 1978. During that month, out of forty rain-gauges installed in a countrywide network, rainfall amounted to 40 mm at Karáanah and 16 mm at Al-Jamiliyah. However, no rain was recorded at the other stations in Qatar.

One of the remarkable features of rainfall in Qatar, as in other arid countries, is the sudden cloud-bursts which bring torrential rainfall. Heavy localized downpours on one day may be more than the average annual rainfall. On one day in December 1964, 80·1 mm were recorded at Doha airport. In that month the rainfall amounted to 155·4 mm. It

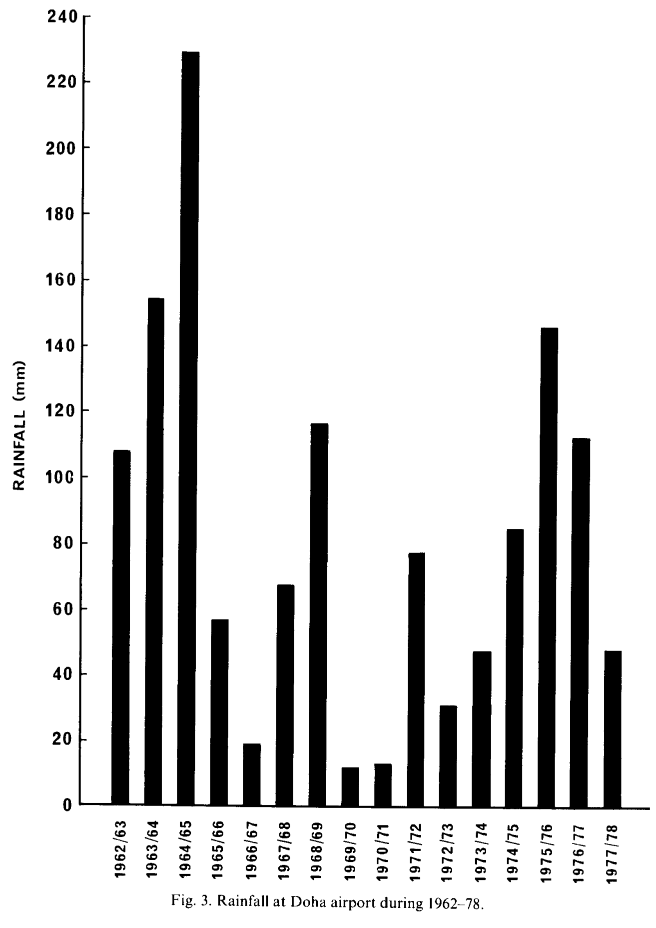


Fig. 3. Rainfall at Doha airport during 1962–78.

TABLE 3

Annual rainfall (October to May) at seven stations in Qatar from October 1972 to May 1978

	STATION						
YEAR	*Ruwais*	*Rodat Al-Faras*	*Al-Kharrarah*	*Trainah*	*Dukhan*	*An-Nasraniyah*	*Doha*
1972/73	10·8	24·7	15·6	18·0	13·0	22·0	31·1
1973/74	29·0	51·0	82·0	100·0	26·5	60·3	47·8
1974/75	62·0	65·8	53·7	42·5	(19·1)*	32·1	84·6
1975/76	205·7	189·2	116·5	137·7	124·1	97·1	146·9
1976/77	125·4	178·3	54·4	59·6	71·5	91·6	113·0
1977/78	23·0	24·4	22·2	24·6	14·2	27·0	48·2
Average	75·9	88·9	57·4	63·7	49·8 (5 years)	55·0	78·6

* Data for all months incomplete.

should be noted that the average annual rainfall at Doha is 87·1 mm and the average rainfall in December at the same station is only 10·3 mm. Such storms can be expected to occur in any month of the rainy season from October to May (Table 2). Pike (1978) gives a record of the significant storms at Doha airport during the period 1959–77. There were twenty storms with amounts ranging from 172·5 mm on 11–16 December 1964, to 11 mm on 10 February 1975. He states that during the period 1972–77, twenty-one significant storms occurred over Qatar, of which only ten were recorded at Doha. Hence, he claims that there is a reasonable probability that at least two storms each winter season have, on the average, occurred over parts of Qatar. These storms result in considerable runoff; the run-on water accumulates in depressions acting as a source of recharge of the groundwater. A few weeks after any of these storms the ground surface in depressions is covered by a green mantle of plant growth, mainly of ephemerals.

It is worth studying the intensity of rainfall at various stations in Qatar. Figure 5 shows the intensity of rainfall at six stations during the period 11–14 March 1979. It appears that there is a wide difference among the various stations. Heavy thunderstorms are experienced at these stations and as much as 16·4 mm fell in 10 min at Karaanah on 13 March 1979. On the same day, 11 mm fell in 20 min. The total rainfall on that day reached 42·8 mm at Karaanah, 0·2 mm at Abu Samra and 11·4 mm at Al-A'miriyah (three stations in southern Qatar). In central Qatar, rainfall on the same day was 18·4 mm at Decca and 3·4 mm at Al-Jamiliyah, while in northern Qatar it reached 3·6 mm at Rodat Al-Faras (government farm).

The aforementioned data indicate high intensities of rainfall resulting from heavy thunderstorms. Also, the patchiness of rainfall in the country is well indicated.

The annual mean number of rainy days with at least 1 mm is low, reaching 7·8 at Doha. The number of rainy days in the different months ranges from 0·1 in October to 2·1 in

TABLE 4

Monthly rainfall (mm) at seven stations in Qatar from January 1972 to December 1978

MONTH	*Ruwais*	*Rodat Al-Faras*	*Kharrarah*	*Trainah*	*Dukhan*	*An-Nasraniyah*	*Doha*
1972							
January	–	30·2	–	–	3·8	14·0	1·8
February	–	17·0	6·5	–	–	–	6·7
March	25·8	25·4	11·9	31·2	11·8	13·2	57·7
April	–	69·4	2·7	7·4	2·2	9·5	9·6
May	–	–	–	–	–	–	–
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	2·5	2·3	–	–	–	–
November	3·8	1·2	1·0	–	–	–	1·0
December	7·0	5·6	–	–	–	–	7·9
1973							
January	–	12·4	12·3	18·0	13·0	19·4	22·0
February	–	–	–	–	–	0·8	–
March	–	–	–	–	–	–	–
April	–	3·0	–	–	–	1·8	0·2
May	–	–	–	–	–	–	–
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	–	–	–	–	–	–
November	–	–	–	–	–	–	–
December	–	0·8	1·8	–	5·0	–	–
1974							
January	–	5·2	1·2	–	–	–	5·8
February	7·0	19·6	34·0	84·0	15·0	26·9	23·4
March	22·0	25·2	45·0	16·0	6·5	33·4	16·7
April	–	0·2	–	–	–	–	1·7
May	–	–	–	–	–	–	0·2
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	10·5	–	–	–	–	–	–
November	–	–	–	–	–	–	–
December	29·6	24·6	–	–	5·5	–	–
1975							
January	13·0	16·0	36·7	40·0	10·0	23·5	4·1
February	5·5	12·8	15·0	–	+	5·5	31·3
March	1·7	4·6	1·0	1·0	1·5	0·9	46·3
April	0·3	4·8	1·0	1·5	2·1	2·2	1·1
May	1·4	3·0	–	–	–	–	1·8
June	–	–	–	–	–	–	–

TABLE 4 (*cont.*)

MONTH	*Ruwais*	*Rodat Al-Faras*	*Kharrarah*	*Trainah*	*Dukhan*	*An-Nasraniyah*	*Doha*
July [1975]	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	–	–	–	–	–	–
November	–	–	–	–	–	–	–
December	0·6	5·5	–	1·0	6·0	2·2	4·4
1976							
January	0·8	9·7	1·5	–	2·5	0·5	25·2
February	73·6	79·4	58·4	72·9	51·8	53·9	53·9
March	85·0	41·6	31·0	25·2	32·6	27·3	23·1
April	45·7	53·0	25·6	38·6	31·2	13·2	4·3
May	–	–	–	–	–	–	–
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	62·6	1·8	–	1·0	–	5·4
November	18·0	3·0	1·0	3·2	–	15·2	45·5
December	14·0	7·0	–	0·6	–	0·4	–
1977							
January	90·0	57·1	36·4	32·6	67·0	38·0	41·4
February	–	5·8	13·8	21·8	3·5	7·6	17·9
March	0·4	5·2	–	–	–	12·6	0·5
April	3·0	37·6	1·4	1·4	–	17·8	2·3
May	–	–	–	–	1·0	–	–
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	–	–	–	–	9·4	17·3
November	–	–	3·6	8·0	–	0·6	8·1
December	8·0	10·6	0·6	–	2·2	5·0	3·1
1978							
January	–	–	–	–	–	–	–
February	15·0	12·8	11·6	10·2	11·0	10·2	12·8
March	–	–	–	0·4	–	–	1·0
April	–	1·0	6·4	6·0	1·0	1·8	5·9
May	–	–	–	–	–	–	–
June	–	–	–	–	–	–	–
July	–	–	–	–	–	–	Tr
August	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–
October	–	1·4	–	–	–	–	–
November	2·4	–	–	–	–	–	Tr
December	–	–	–	–	–	–	Tr

+ Not recorded. Tr means rainfall less than 0·1 mm.



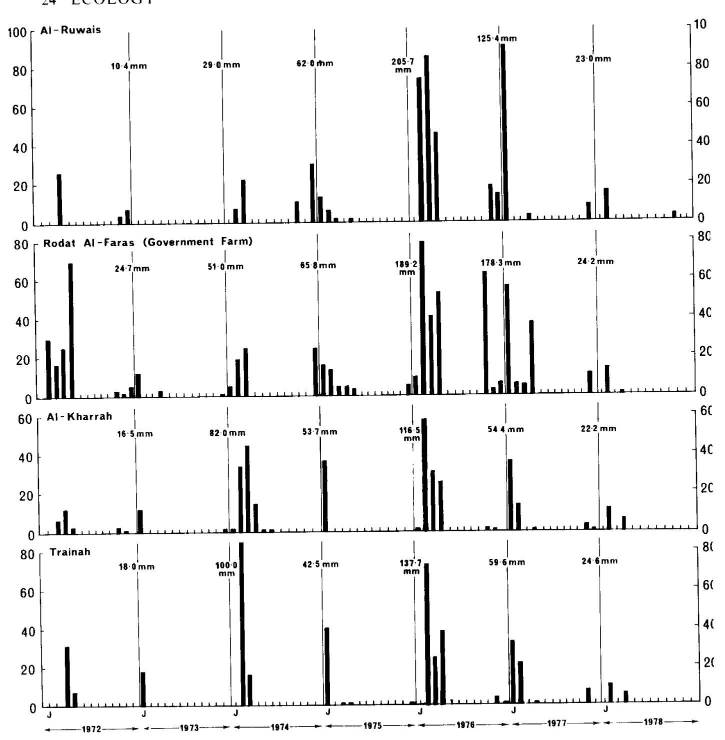


Fig. 4. Monthly rainfall at Al-Ruwais, Rodat Al-Faras, Al-Kharrarah and Trainah during 1972–78.

February. The highest number of rainy days (more than 1 mm) was recorded in 1964, reaching 22, while there was no day with rainfall above 1 mm recorded in 1962.

Variation in rainfall, together with accidental cloud-bursts, has considerable effect on plant life. As a consequence of the scanty rainfall, the soil moisture supply to the plants is very scarce and variable. The desert soil (surface deposits) is almost air-dry all the year round except for a few days in winter and spring. Subsurface layers of deep soils may

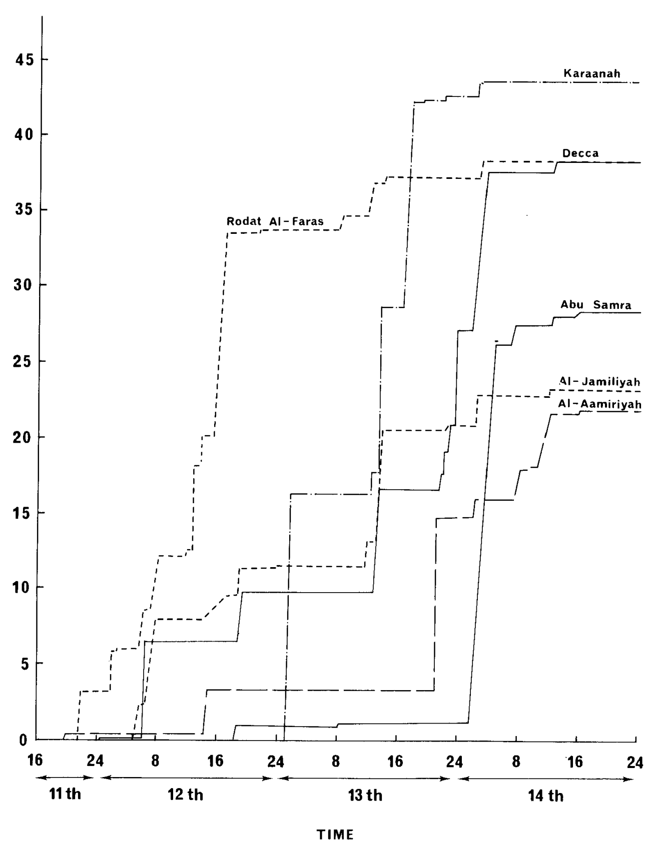


Fig. 5. Rainfall records at six stations during the storm of 11–14 March 1979.

comprise a permanently wet layer. This represents a permanent source of moisture to deeply penetrating roots of perennials.

AIR TEMPERATURE

Qatar has a hot desert climate, with mild winters and very hot summars. Temperature records at Doha (Table 5 and Fig. 6) show that not a single month has a mean temperature below 17·1°C, and the mean minimum temperature does not drop below 12·7 C. The lowest temperature records are those of January, with a mean of 17·1°C, a mean daily maximum of 21·9°C, and a mean daily minimum of 12·7°C. The abolsute maximum in January is 30·7°C and the absolute minimum is 3·8°C. There is never a danger of frost. From March onwards temperatures increase steadily with a rapid increase in May. Maximum temperatures are reached in July or August. The mean temperature in July is 34·5°C, the mean daily maximum reaches 41·2°C and the mean daily minimum is 28·8°C. The mean daily minimum in July is higher than the mean daily maximum in the winter and early spring months. The highest record of air temperature at Doha is 49°C in June 1962. It should be noted that the temperatures given were measured with instruments placed inside the standard meteorological screen, erected about 2 m above the ground surface. Therefore, they do not indicate the temperature that exists on the ground surface or just above it where plants grow. The wide amplitude of air temperature, both seasonally and daily, is even greater near the ground surface. This is an extremely important fact which affects the growth of plants in Qatar.

TABLE 5

Air temperature records at Doha airport for 17 years (1962–78)

	MEAN (°C)			ABSOLUTE (°C)	
MONTH	*Monthly*	*Daily maximum*	*Daily minimum*	*Maximum*	*Minimum*
January	17·1	21·9	12·7	30·7 (1966)	3·8 (1964)
February	18·0	23·1	13·5	36·0 (1971–73)	5·0 (1967)
March	21·4	27·2	15·8	39·0 (1966)	8·2 (1963)
April	25·7	31·3	20·1	46·0 (1972)	10·5 (1967)
May	30·6	37·6	24·3	46·0 (1972–73)	15·2 (1971)
June	33·6	40·5	27·3	49·0 (1962)	21·0 (1967, 1970 and 1975)
July	34·5	41·2	28·8	46·7 (1976)	23·5 (1969)
August	34·0	40·6	28·3	48·0 (1977)	22·4 (1971)
September	32·0	38·5	20·1	45·5 (1965)	20·3 (1964)
October	28·7	35·2	22·8	43·4 (1967)	16·6 (1975)
November	21·2	29·3	19·2	38·0 (1969)	11·8 (1963)
December	19·0	25·3	14·7	32·2 (1968)	6·4 (1963)
Year	26·5	32·5	21·3	–	–



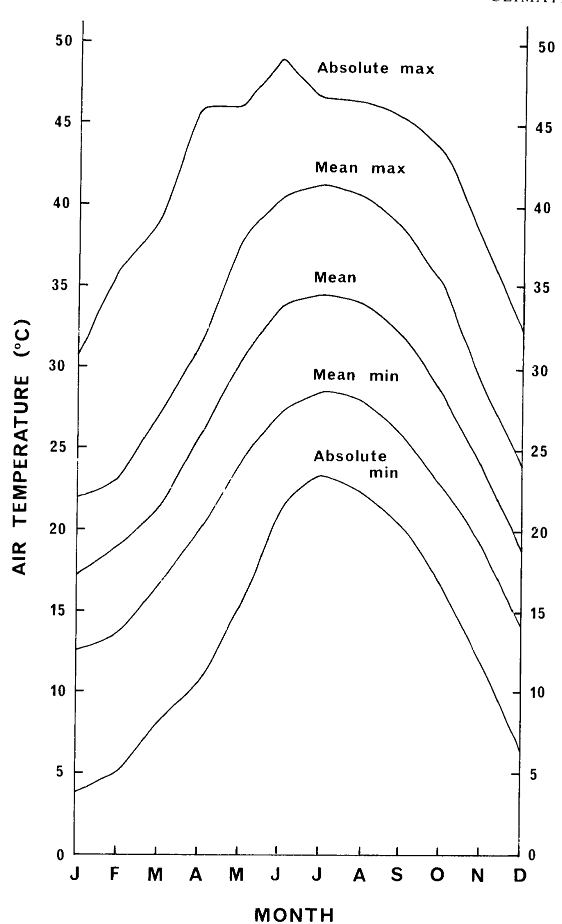


Fig. 6. Air temperature records in the different months at Doha airport.

Despite the fact that Qatar is a relatively low-lying peninsula protruding into the Arabian Gulf, the temperature regime closely resembles that of inland sites of eastern Saudi Arabia of a moderate continental type (Pike, 1978). Pike (1978) states that the maritime effect of high humidity and a reduced range in mean air temperature is confined to a narrow coastal belt. He finds that within 10 km of the coast the average range of air temperature is increased by 2·5°C, with the night-time minimum temperature during summer 3–4°C lower than on the coast.

It is worth noting that the range between mean minimum and mean maximum temperatures is wider in summer than in winter months (Table 5 and Fig. 6). This holds true in the case of daily variation in temperature, being wider in summer than in winter (Fig. 7).

The location of the temperature recording stations at Rodat Al-Faras, Decca and Abu Samra results in hampering the comparison of temperature conditions with those at Doha airport. Decca is near Doha and the other two stations are located within or near farms. No doubt agricultural practices have evident consequences on the microclimate.

Pike (1978) points out the difference in temperature regime between the east and west coast of Qatar. Throughout the year both maximum and minimum temperatures on the west coast are some 1–4°C lower than on the east coast, and this is brought about by the general cooling effect of the onshore north-westerly wind along the west coast, whereas the east coast lies in the lee of this prevailing wind and is subjected to advection from the warmer interior, particularly during the summer.

The daily march of hourly mean air temperature in January and July 1977 at Doha airport is shown in Fig. 7. A glance at the figures reveals the wide difference between air temperatures in the two months. With respect to the daily variation, it is wider in July than in January. The hourly mean ranges from 13·1°C at 4 a.m. to 18·6°C at 10 and 11 a.m. in January, while it ranges from 30·6°C at 2 a.m. to 40·5°C at 9 a.m. in July. It is interesting to note that the maximum hourly means are reached before noon during the two months.

The aforementioned data show that plants growing in Qatar are subjected to drastic temperature conditions during summer as well as wide seasonal and daily fluctuations of air temperature. However, only the perennial plants are exposed to high summer temperatures; ephemerals exist only during the favourable season.

AIR HUMIDITY

The relative humidity records at Doha airport (Table 6) show that the mean annual relative humidity is 61·7%, indicating high humidity throughout the year. The mean monthly relative humidity is above 70% in the winter months. A gradual decrease occurs in March and April till a minimum of 45·5% is reached in June. It is noteworthy that an abrupt increase in the mean monthly relative humidity is observed in August reaching 57·7%. The values of mean relative humidity increase gradually, reaching 74·8% in December. Pike (1978) attributes the abrupt increase of relative humidity at the end of July to the influence of the northern limit of the intertropical convergence zone or monsoon front, lying at this time along the eastern Arabian coast and into the Indian subcontinent, and extending into the Arabian Gulf, bringing no rainfall but doldrum-type weather and very high humidity values, reaching 99% during the night.



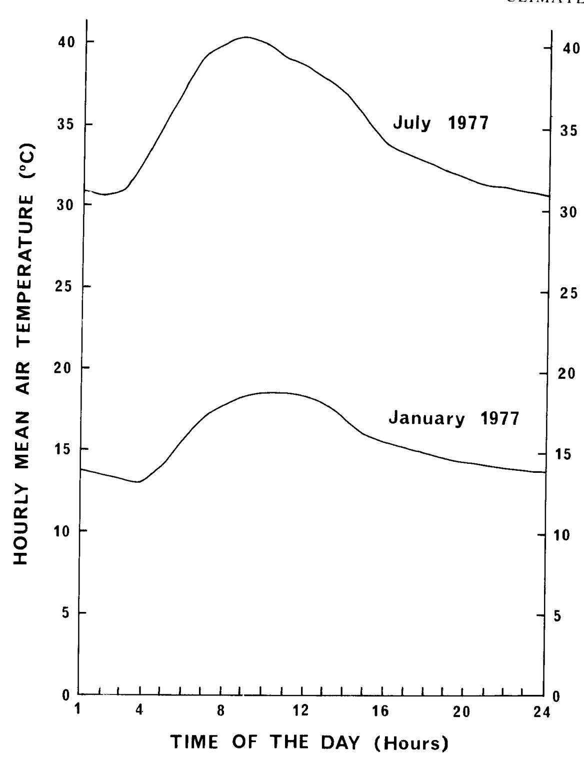


Fig. 7. Hourly mean air temperature in January and July 1977.

The mean daily maximum and minimum relative humidity values exhibit the same trend as that of the mean monthly values. The mean maximum ranges from 69·5% in June to 91·3% in December, while the mean minimum ranges from 23·3% in May and June to 52·2% in December.

The relative humidity, though generally high in Qatar with absolute maxima of 100% every month all the year round, reaches very low absolute minima ranging from 5% in July to 28% in December.

TABLE 6

Relative humidity records at Doha airport during 4 years (1975–78)

MONTH	MEAN (%) Monthly	Daily maximum	Daily minimum	*Absolute* minimum (%)*
January	73·2	89·7	51·7	15·0
February	75·0	92·0	49·0	14·0
March	66·2	86·5	40·2	17·0
April	54·9	78·0	30·2	8·0
May	46·3	70·5	23·3	8·0
June	45·5	69·5	23·3	8·0
July	49·5	73·2	26·0	5·0†
August	57·7	82·3	32·7	8·0
September	64·0	85·8	32·3	9·0
October	66·9	88·3	38·8	9·0
November	65·8	84·3	43·0	13·0
December	74·8	91·3	52·2	28·0
Year	61·7	82·6	36·9	

*The absolute maximum in all months is 100%.
†On 11 July 1976.

Relative humidity undergoes a wide daily variation in addition to the seasonal-wide amplitude. On summer days, extremely low values can be recorded during the early afternoon hours, while high values occur at night. The same, but with a narrower range, occurs in winter months.

Relative humidity is not a statement of the actual moisture content of a volume of air, but a statement of this amount as a percentage of the maximum quantity that the air can hold at the prevailing temperature. Therefore, it must be taken into consideration that the value of the relative humidity is not of significant importance to the plant life without knowing the air temperature. Equal values of relative humidity do not mean similar atmospheric humidity conditions except with all other factors, including temperature, remaining constant. For example, relative humidity values of 70% can be recorded in summer and winter, but the water vapour needed to saturate the atmosphere (i.e. to be 100% relative humidity) at low temperatures in winter is less than that needed at high temperatures in summer. This is due to the fact that warm air can hold more water vapour than cold air. The capacity of air for holding invisible water vapour doubles with each increase of 11°C in temperature. It follows that, when the relative humidity is 70% at 20°C in a winter month and at 31°C in a summer month, the water vapour needed to saturate the atmosphere (the vapour saturation deficit) in summer is double that needed in winter. Hence, the rates of evaporation and transpiration will be higher in summer than in winter even under the same relative humidity values. The use of vapour saturation deficit values

is more significant in ecological studies than those of relative humidity. Usually, vapour pressure deficit values are high in desert areas.

EVAPORATION

The data calculated by Pike (1978) for the evaporation from open water and the evapo-transpiration are given in Table 7. It is clear that evaporation and evapo-transpiration

TABLE 7

Mean open water evaporation (Penmann) and modified potential evapo-transpiration at three stations in Qatar (Pike, 1978)

	EVAPORATION (mm)			EVAPO-TRANSPIRATION (mm)		
MONTH	*Rodat Al-Faras*	*Decca (Abu Nkhalah)*	*Abu Samra*	*Rodat Al-Faras*	*Decca (Abu Nkhalah)*	*Abu Samra*
January	86	101	96	75	104	88
February	100	109	80	92	101	85
March	154	149	133	142	175	132
April	222	219	202	201	234	192
May	267	249	264	259	252	311
June	287	286	298	270	378	344
July	283	266	274	268	372	310
August	255	285	248	190	283	191
September	221	234	208	161	223	164
October	173	177	135	144	188	213
November	128	135	111	105	142	116
December	90	98	91	80	108	95
Year	2,265	2,309	2,141	1,987	2,560	2,244

values vary from one station to the other. However, the seasonal drift of the evaporation values is similar at the three stations. Low values are recorded in January then a slight increase can be observed in February. In March and the following months, a considerable sharp increase is observed till a maximum is attained in June. It is clear from Fig. 8 that evaporation from open water remains at a level higher than 250 mm/month during the period extending from May to August. This is followed by a slight decrease in September. By the advent of winter, evaporation decreases to low levels. The data of evaporation, as calculated by Pike (1978), show that the evaporation is kept at a level above 200 mm/month during 6 months per annum. Months with high evaporation values are those without rain and have high air temperature values. This fact evinces how far the perennial plants are subjected to severe evaporative power of the atmosphere during the period extending from April to September.

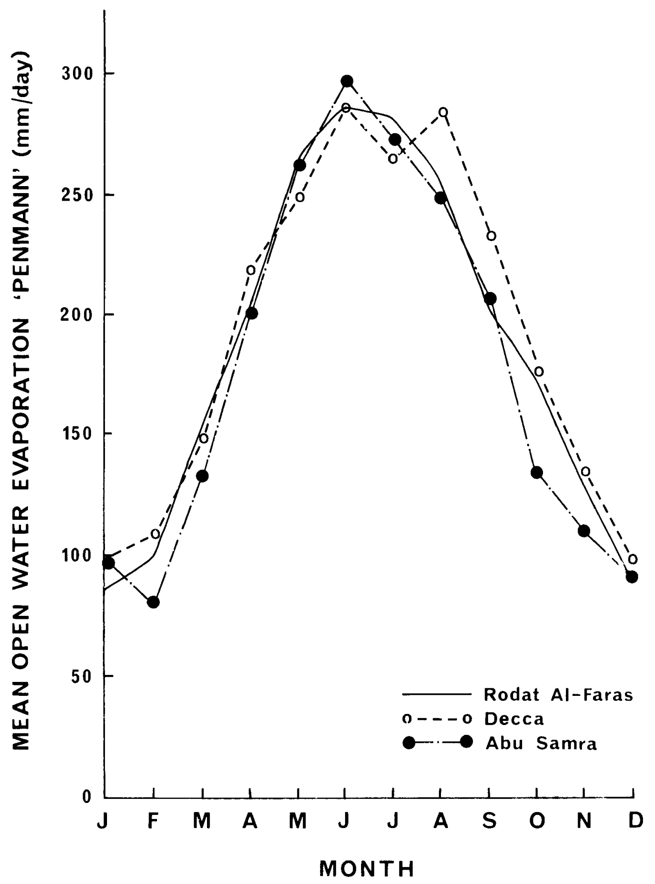


Fig. 8. Mean open water evaporation (Penmann) at Rodat Al-Faras, Decca and Abu Samrah.

CLIMATIC ARIDITY

The clima-diagram (Walter, 1955) for Doha (Fig. 9) shows that the precipitation curve underlies the temperature curve throughout the year. The area lies within the subtropical dry zone of the desert, and no humid period prevails during the whole year.

As a consequence of the severe climatic aridity, the soil moisture supply to plants is meagre. The uppermost soil layers are almost dry all the year except on a few days after rainfall. The soil moisture content in these layers exhibits very wide fluctuations, which

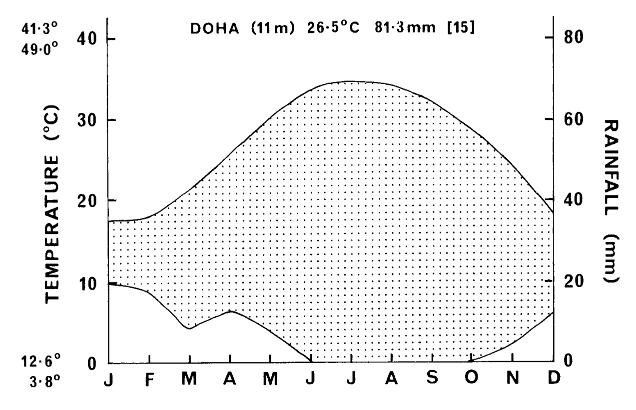


Fig. 9. Climatic diagram of Doha.

may lead to the failure of emergence of germinating seeds or at least all the emerging seedlings fail to complete their life-cycle. The rapid depletion of soil moisture in the upper layers is mainly due to the high evaporative power of the atmosphere. Due to the coarse texture of the soil, the percolated rain water in deep layers is protected from evaporation. Loss of water from deep layers below 50 cm is solely due to root absorption. Water content of the deep layers is usually kept at a relatively high level through all the year. Some of the perennials tide over periods of severe drought in a green state or flowering. This indicates the presence of available water in the deep layers which is utilized by the plants.

WATER RESOURCES

Scarcity of water resources is the main problem facing Qatar as is the case in many countries in the arid zone. There is no permanent surface water in Qatar and search for groundwater has been practiced since remote times. The nomadic inhabitants of Qatar developed the early hand-dug, hand-drawn wells as water supplies for domestic use, for their animals and for limited seasonal agriculture. However, investigation on scientific bases started in the thirties of this century with the onset of oil exploration surveys. Williamson and Pomeyrol (1938) have provided the earliest reliable data on water levels in Qatar in a study oriented towards the provision of water supplies for exploratory drilling operations. In that study, 118 wells were inventoried.

Since oil production on a commercial scale in 1949, the socio-economic changes resulted in a great need for water. A Water Department was created within the Ministry of Electricity and Water in 1954. At that time, only two well-fields constructed by the Qatar Petroleum Company (QPC) were in production.

The first comprehensive study of the hydro-geology of northern Qatar was undertaken by Le Grand Asco in 1957–59. Additional well-field sites were identified and subsequently developed to provide a water supply to Doha. Later in 1960–61, Parsons carried out a survey of water resources in Qatar. In 1966, an evaluation of water sources for a Doha water supply was undertaken by Sogreah.

In 1967 it was recognized that not only was the water supply inadequate, but also the continued demands being made on groundwater were exceeding the safe yield of the aquifer (Burdon, 1967).

Hydro-agricultural surveys project (UNDP/FAO) started in 1971 with the principal aim of preparing a comprehensive inventory of the country's water and soil resources and existing levels of extraction for agricultural and municipal purposes. Surveys showed that extraction of groundwater began to exceed average recharge in about 1966 and that this state of mining was being progressively increased each year.

Further, in 1974 an integrated water and land-use project (UNDP/FAO) was commenced. The data and information embodied in this part are mainly extracted from the results given in the technical reports prepared by FAO.

SURFACE WATER

No permanent surface water exists in Qatar. Rainfall is characterized by scantiness, variability and irregularity (see the previous chapter). However, the nature of the ground surface in Qatar, being with numerous depressions bordered by elevated, eroded rocky ridges (*hozoom*), enhances surface runoff. Due to numerous intermingled factors—including the size, shape of catchment area, vegetation, topography and soil properties, as well as amount, intensity and distribution of rainfall—runoff varies widely in the different localities. Runoff generally occurs after 8–10 mm of rain, provided that soil moisture has been brought to near field capacity (UNDP/FAO, 1977).

After storms with considerable rainfall, water accumulates in depressions (Plates 11a, b, c, d). Water runs on the rocky surfaces of *hozoom* or in narrow runnels and accumulates in the depressions. The depressions do not lie at the same level, and when they are full of water following storms, one depression may drain its water into the next lower one through connecting runnels which are at levels higher than the base of the depressions themselves.

By the accumulation of water in the depression, evaporation and infiltration go hand in hand; their rates depend on numerous factors. The infiltrated water enriches the soil moisture and further recharge takes place. Under conditions of heavy storms, the accumulated water may remain for several days on the ground surface. This results in the inhibition of germination in lower parts as regards local topography due to lack of aeration and sedimentation of fine deposits. Seedlings appear only along the margins of the ponded water and on elevated parts. With the retreat of water, due to evaporation and infiltration, there may be a chance for seeds to germinate. The density of germinating seedlings is very high in depressions after a rainfall of 10 mm, amounting to 1,800 seedlings per square metre or more. The progressive desiccation of the uppermost layers results in the rapid mortality of numerous seedlings. Some of the newly developed plants may complete their life-cycle within a few weeks after emergence. Within the same depression, shrubs growing in the centre of the depression with deep soil flourish and flower earlier than those along the margins with shallow soil.

GROUNDWATER

Investigations by the UNDP/FAO project (1977) have shown two separate and distinct groundwater provinces.

1. The northern groundwater province, in the northern half of the peninsula, where groundwater occurs as a fresh-water floating lens on brackish and saline water. This fresh water is contained in limestone and dolomites of the Dammam and Rus (Eocene) formations and is underlain by saline water contained within the Umm er Rhaduma (Paleocene) formation. It is the most important source of reasonable quality groundwater to Qatar, and is estimated to contain some $2{,}500 \times 10^6$ m^3 of fresh water, with the base of the lens of fresh water/saline water interface at a level of approximately 100 m below sea level. The lens is now in a non-steady state condition brought about by over-extraction as evidenced by declining water levels and a shrinking volume.

2. The southern groundwater province, which is altogether different, the occurrence of fresh groundwater being confined to a perched aquifer of marginal quality water overlying dense impermeable limestones, except where fracturing associated with the southern extension of the Dukhan structure has increased the permeability and allowed more recent and concentrated recharge, as well as the upward leakage of deeper, more saline water. In this comparatively narrow zone, a minor fresh-water lens with a maximum depth of 40 m has developed.

This province encompasses more than half the land area of Qatar and where hydrogeological conditions are considerably more complex than those of the north.

The chemical quality of groundwater varies widely in the two provinces. Water from the northern fresh-water lens has a total dissolved-solids concentration ranging from 400

to 2,000 ppm. The salinity of groundwater in the southern area ranges from 3,000 to 6,000 ppm, except for small isolated lenses of water of 2,000–3,000 ppm. In the extreme south-west, at Abu Samra, free-floating wells with a total dissolved-solids value of 3,000 ppm have been developed from a complex, but probably limited, confined aquifer with a recharge source in Saudi Arabia.

The depth to groundwater in Qatar generally reflects the regional topography with the deepest levels located along the axis of the central arch of Qatar and beneath the elevated mesa-type hills of southern Qatar. In the northern groundwater province, the depth to the water table is generally less than 30 m in most localities; deepest levels reach 40 m below ground surface. In southern Qatar, the water level is in excess of 30 m below ground surface, reaching 80 m at points.

WATER BALANCE

Computation of the water balance of these two provinces was carried out for the period from 1971/72 to 1978/79. The data are given by Harhash (1980) in his study on rainfall–runoff–recharge evaluations. It has been shown that the average annual recharge is 22·4 million cubic metres ranging from 6·1 million cubic metres in 1972/73 to 50·5 million cubic metres in 1975/76. The total extraction, including the agricultural and domestic consumption as well as the subsurface outflow to the Gulf, has an average of 38·2 million cubic metres. This means that the depletion is of the order of 15·8 million cubic metres per annum.

In the southern province, the average annual recharge is 20 million cubic metres, while the average annual extraction is only 14·4 million cubic metres. Harhash (1980) attributes this to the low agriculture and domestic extraction in the south of Qatar.

SURFACE GEOLOGY*

The peninsula of Qatar occupies 10,600 km^2, with Tertiary sequence covering about 80% of this area. Only 20% of the total area is covered by Quaternary and Recent deposits. It is noteworthy to mention that older formations from the Paleozoic era are exposed in two offshore islands, namely Halul and Shara'ou.

The geology of Qatar is given in a few works (cf. Smout, 1954; Powers, 1968; Stocklin, 1968; Taylor & Illing, 1969; Cavalier, 1970; Sygden & Standing, 1975). A number of geological maps have been compiled by the Qatar Petroleum Company, 1:250,000. Recently, Cavalier *et al.* (1970) compiled a more detailed map, 1:100,000.

Three main structural elements can be recognized. The major part of the peninsula is formed by a broad, north–south trending anticline. This is separated by a syncline from the more pronounced, narrow, elongated, north–south trending Dukhan anticline.

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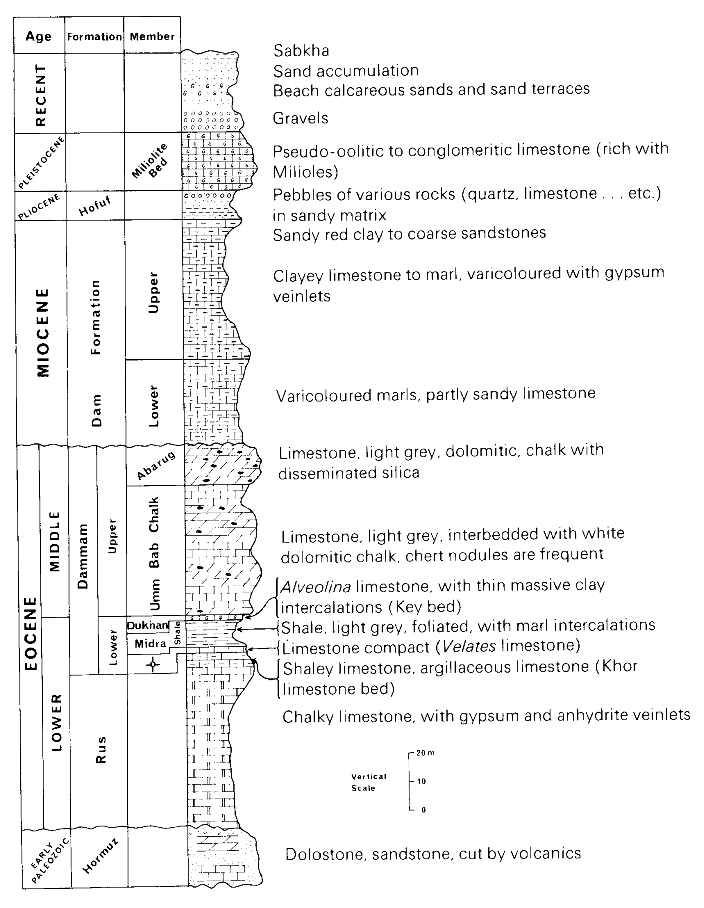


Fig. 10. Composite columnar section representing the rock sequence in Qatar.

Diaperitic salt domes are responsible for the outcropping of the Paleozoic rocks in both Halul and Shara'ou islands.

Lithologically, the main rock types outcropping in Qatar are limestones, dolostones and marls with some shales and evaporites. Sands are present in part in some Pleistocene and Recent deposits. In Hormuz formation (Halul and Shara'ou) volcanics (andesite and thyolite) are present in considerable amounts. Figure 10 is a compiled columnar section representing the rock sequence in Qatar. Plate 12 shows the distribution of the main rock units over the surface of Qatar. The Rus formation (Lower Eocene) consists mainly of chalky limestone with some gypsum and anhydrite. The Dammam formation is subdivided into a lower (Lower Eocene), mainly shaley subformation, topped by the marker *Alveolina* limestone Member, and an upper Dammam subformation (Middle Eocene). This subformation is built of dolomitic limestones with chert nodules. The Dam formation, deposited during the Middle and Late Miocene, consists in its lower part of varicoloured marls and sandy limestones, and in its upper part of limestone with minor clay and sand, intercalated by evaporites. The Mio-Oligocene Hofuf formation is conglomeritic with calcareous cement. Quaternary and superficial deposits in Qatar are very widely distributed. They consists mainly of beach conglomerates, pseudo-oolitic and conglomeratic limestones and sands. Silts are deposited as internal drainage in differently shaped depressions which are more frequent and flat in the north, deeper and more or less circular in the middle. Eolian sands as sheets and dunes cover the southern part of Qatar and extend to the south-eastern coastal plain, where the sheets dominate in the north-east and west, and the dunes are concentrated to the south-east.

VEGETATION

SALIENT FEATURES

Though the topography of Qatar does not exhibit a considerable variation, yet the local variations are distinct and affect the plant life. *Rodat* and depressions harbour denser vegetation compared to the sparse plant cover on the *hozoom*. Apart from salines, the density of plants is mainly affected by the physical properties of the soil, *viz*. texture, structure and depth. This is mainly due to the influence of these properties on the amount, availability and continuity of the water supply. Usually trees and shrubs are confined to depressions with relatively deep soil.

The vegetation of Qatar, as in other parts of the arid zones, is characterized by openness. It is composed of a permanent framework of perennials, the interspaces of which may be occupied by ephemerals after rains. The appearance of ephemerals and their duration, either in the presence or absence of a perennial framework, depend on the amount and distribution of rainfall. An open vegetation with widely spaced perennials reduces root competition and minimizes the amount of water withdrawn by roots per unit volume of soil. Development of ephemerals in winter may not cause intensive competition with perennials due to the layering of roots; those of ephemerals are restricted to the

uppermost 20 or 30 cm, whereas roots of perennials extend to deeper layers. Reduction of competition among roots favours their free development which is a most important factor in drought resistance. Competition among desert plants may be conceived as operative in an indirect way. It has been shown that densely vegetated habitats have more water output than those with low plant cover (Abdel Rahman & Batanouny, 1965). The open plant cover may help to reduce this (or any other) type of competition.

The vegetation is subject to seasonal variation in its aspect, particularly in rainy years. After rainfall, many seedlings, particularly of ephemerals, emerge. After a rainfall of 10 mm, the number of seedlings in a shallow depression reached 2,000 per square metre. However, the mortality rate in the new seedlings population is high. Within a short period, depending on the distribution of rainfall, the number of seedlings is considerably reduced. High mortality among these shallowly rooted seedlings is an evidence of competition; their roots exploit the same upper 20 or 30 cm which desiccates rapidly.

An interesting feature of the ephemeral plant growth is that new individuals seem to occupy areas around the dried individuals of the previous year. This is particularly apparent in the case of *Anastatica hierochuntica* (*Kaff Maryam*), *Trigonella* spp., *Plantage* spp., *Medicago* spp., *Neurada procumbens* (*Seidan*) and *Astragalus tribuloides*.

The obvious variation of the vegetation coincides with the seasonal drift of the atmospheric factors. In years with low rainfall, the seasonal changes are not as remarkable as in rainy years. The floristic composition and the density of plants exhibit no wide variation due to the absence of ephemeral plant growth.

The phenology of the plants is largely related to the environmental conditions, particularly rainfall, air temperature and soil moisture as well as inherited characters of these plants. Changes in the phenology of the different species constituting the vegetation reflects detectable variations in the seasonal aspects of the vegetation. Even in the same growing season extending from late autumn to early summer, the aspect of the ephemeral growth exhibits considerable variation during the season. These variations are closely related with the distribution of rainfall. Early rains combined with low temperatures of December result in the emergence of a particular ephemeral population, which flowers in early spring. Late rains combined with mild temperatures in March cause the appearance of another group of ephemerals which flower in late spring. There is a rhythmic variation in the kind of species during the same season. These aspects of the succeeding stages are obvious in years with evenly distributed rainfall. Temperature conditions control the appearance and flowering of each group of species. The temporal distribution of ephemerals all over the season is a means by which each group of ephemerals will find their needs of the environmental components at a definite time. If all the naturally occurring seed population germinates at the same time, the severe competition leads to the disappearance of various species. This temporal distribution is important in the water economy of the newly growing plants during the same season.

Severe environmental conditions reduce the rate of establishment of plants and even may cause the uprooting and death of already established individuals. Numerous factors are responsible for the reduction of the number of perennials newly added to the vegetation every year; the vegetation is consequently maintained open. Among these reasons may be mentioned in the first place the rapid drying of the upper soil layers by the advent of summer. Other agents include wind, grazing animals and cutting of plants for fuel; these help in uprooting and/or exterminating plants. Death of some perennials

through age is a normal process. In years with heavy rainfall, there is ample room for adding new perennial individuals to the vegetation. Under such conditions, the rain water percolates down and reaches the permanently wet layer, thus creating a continuous (wet) zone extending from the soil surface till that layer. Hence, roots of the newly developed individuals of perennial plants succeed in reaching the deeply seated permanently wet layer before the onset of summer. Establishment is thus achieved. Under the scanty rainfall conditions that are of more frequent occurrence, the rain water moistens only the uppermost layer which is thus separated from the deeply seated wet layer by an intervening dry zone. This dry zone acts as a barrier that hinders the healthy development of roots of newly growing perennials and does not allow for their penetration to the permanently wet layer. Establishment thus fails.

The majority of the flowering plants of the flora of Qatar is represented by therophytes. The elimination of such a high number of plants in summer is an important means to minimize the water output from the vegetation. Phanerophytes are represented by six species, which are nanophanerophytes. Cactus-like succulents are not represented in the flora of Qatar.

Despite the very strict division between annuals and perennials, the plants recorded as 'biennials' by some investigators were given as either annuals or perennials by others. Some species such as *Zygophyllum simplex*, *Arnebia hispidissima* and *Sclerocephalus arabicus* have been observed to perennate till the next growing season. On the other hand, some species may complete their life-cycles within a few weeks. This occurs usually when rain falls leading to the germination of seeds of ephemeral species and no rain comes during the rest of the season. Newly appearing seedlings escape drought by flowering and fruiting quickly. However, in a good rainy season many perennials succeed in flowering and setting fruit in their first season, so that even if they are killed by the drought of the following summer they have completed a full life-cycle as potential annuals. This ability may be an important biological factor in their survival.

PLANT COMMUNITIES

It is not intended to give a complete description or a census of the plant communities in Qatar, but rather to give a brief account of the more important communities with notable contribution to the vegetation.

NON-HALOPHYTIC PLANT COMMUNITIES

1. ***Ziziphus nummularia*** *community* (Plate 3a)

This community is found in the *rodat* with deep fine-textured soil resulting mainly from the accumulation of water-borne material. The *rodat* supporting this community are mainly observed in north and central Qatar, though they may occur in limited areas in southern Qatar.

The individuals of the dominant plant accumulate water-borne and wind-blown sediments around their bodies. The sizeable mound formed by the plant is locally known as *nabk*. The mound body is formed by successive layers with variable texture. In the

shadow of the dominant plant, these mounds offer ample room for a dense growth of ephemerals and some perennials. The plant cover ranges from 40% in summer to 80% in spring.

The common perennial associates include: *Acacia tortilis* (usually present along the margins of the depression or on slightly elevated parts); *Lycium shawii*, *Francoeuria crispa*, *Zygophyllum quatarense*, *Corchorus depressus* and *Salvia aegyptiaca*. In some *rodat*, *Capparis spinosa* is a very common associate and grows in the interspaces among the individuals of the dominant plant. *Ephedra foliata* and *Ochradenus baccatus* are recorded in considerable abundance in some protected *rodat*. These species grow among the *Ziziphus* plants and are protected by the spiny branches of the dominant plant from grazing by camels. In only two localities, namely Al-Karrarah and Al-Wabrah, *Cocculus pendulus* has been recorded climbing on *Ziziphus* trees.

After considerable rains, the *rodat* are flooded with water which is loaded with fine sediments. A few weeks later, a dense luxuriant growth of ephemerals covers the ground surface. The slight relief and in turn the water revenue of the various spots, affect the distribution of the growing ephemerals within the *rodah*. A list of the common ephemerals is given: *Stipa capensis*, *Trigonella stellata*, *Astragalus tribuloides*, *Schismus barbatus*, *Spergularia bocconi*, *Spergula fallax*, *Asteriscus pygmaeus*, *Eragrestis ciliaris*, *E. cilianensis*, *Trachynia distachya*, *Phalaris paradoxa*, *Althea ludwigii*, *Malva parviflora*, *Anagallis arvensis*, *Vicoa pentandra*, *Erodeum laciniatum*, *Emex spinosus*, *Geranium molle*, *Plantago amplexicaulis*, *Aizoon canariense* and *Anastatica hierochuntica*.

2. ***Acacia tortillis*** *community*

The dominant plant is a shrub 2–3 m high, or sometimes higher in protected areas. The co-dominant plant is *Lycium shawii*. This community is widespread in Qatar except in sabkhas and dune fields. Though the dominant plant grows scattered on the *hozoom*, yet it dominates a community abounding in the depressions. The habitat supporting this community differs from that supporting *Ziziphus nummularia* community. In the *Acacia tortillis* community, the deposits are mainly sandy wind-blown material. They are usually shallow and stones may occur on the ground surface.

This community has a wide ecological and sociological range. It is divisable into two subtypes on a floristic and ecological basis. One of these abounds in north and central Qatar in shallow depressions compared to the deep ones supporting the *Ziziphus* community. The soil is shallow and coarse-textured. The water resources of this habitat are less than those of the habitat of the *Ziziphus* community. Associated species of this type are: *Lycium shawii*, *Zygophyllum quatarense*, *Francoeuria crispa*, *Salvia aegyptiaca*, *Heliotropium bacciferum*, *Herniaria hemistemon*, *Fagonia bruguieri*, *Eragrostis ciliaris*, *Atractylis carduus*, *Astragalus tribuloides* and *Stipa capensis*.

The second subtype occurs on sandy depressions in southern Qatar. Deposits are mainly wind-blown coarse-textured material. While in the first subtype *Zygophyllum quatarense* preponderates among the shrubs of the dominant *Acacia*, here in the second subtype *Panicum turgidum* exhibits high presence values. The common associates are: *Lycium shawii*, *Panicum turgidum*, *Eleusine compressa*, *Heliotropium bacciferum*, *Neurada procumbens*, *Lotononis platycarpa*, *Fagonia ovalifolia*, *Rhanterium epapposum*, *Glossonema edule*, *Convolvulus deserti*, *Monsonia heliotropioides*, *Polycarpaea repens*, *Corchorus depressus*, *Helianthemum lippi* and *Eremopogon foveolatus*.

3. ***Cymbopogon parkeri*** *community* (Plate 3c)

The dominant plant is an aromatic perennial grass. This community occurs in depressions (*rodat*) in northern Qatar. Soils supporting this community are fine-textured, compact and mainly deposited through the effect of water running on the slopes to the depression. The tree layer is not well represented in this community; a few scattered individuals of *Acacia tortilis*, *Lycium shawii* and *Ziziphus nummularia* may be present.

In summer and by the end of the dry season, the landscape of this community appears dry. Parts of the dominant plant, to the periphery of the tussock, are dead and only inner parts remain green. This is a means by which the plant reduces its transpiring surface in summer. By the onset of the rainy season, the plant flourishes and produces new green tillers and leaves. The interspaces between the *Cymbopogon* individuals are occupied by a green mantle of ephemeral growth, mainly *Stipa capensis*, *Trigonella stellata*, *Schismus barbatus*, *Plantago amplexicaulis*, *Ifloga spicata*, *Spergularia bocconi*, *Aizoon canariense*, *Zygophyllum simplex* and *Anastatica hierochuntica*.

Among the perennial associates may be mentioned: *Helianthemum lippii*, *Launaea nudicaulis*, *Salvia aegyptiaca*, *Francoeuria crispa* and *Herniaria hemistermon*.

On the elevated parts (*hozoom*) bordering the depressions supporting this community lichens are found on the stones. When the rain is in the form of light showers and durates for a long time—a type of rain known locally as *inmeili*–there is a chance for water to permeate between the rocks of the *hozoom*. Hence, an ephemeral cover appears on these elevated habitats. Heavy showers for a short period enhances runoff and offers no chance for permeation of water to the deposits below and between the stones on the *hozoom*. It is to be noted that I have learned the term *inmeili* given to the light showers of long duration, also the effect of such showers, from my Qatari friend Sheikh Hassan Al Thani.

4. ***Panicum turgidum*** *community* (Plate 10b)

The dominant plant is an effective soil binder. This grass is palatable to animals and usually is being overgrazed beyond its capacity to remain vigorous. The community dominated by *Panicum* occurs in the southern part of the peninsula of Qatar. It occurs either in the *rodat* with sandy deposits or in the sandy accumulations in the furrows in the ridge between Dukhan and Umm Bab. In the *rodat*, the tree layer is represented by *Acacia tortilis* which grows usually along the margins of the depressions or on slightly elevated microsites in the depression. In this case the associates are represented by perennials as: *Zygophyllum quatarense*, *Rhanterium epapposum*, *Eremopogon foveolatus*, *Lycium shawii*, *Chrysopogon aucheri*, *Hammada elegans*, *Polycarpaea repens*, *Lasiurus hirsutus*, *Aerva javanica*, *Stipagrostis plumosa* and *Neurada procumbens*.

On the other hand, in the sand accumulations along the ridge of Dukhan–Umm Bab, the community of *Panicum turgidum* lacks the presence of trees. The common associates are: *Maltkiopsis ciliata*, *Monsonia heliotropioides*, *Stipagrostis plumosa*, *Fagonia ovalifolia*, *Cyperus conglomerates*, *Cornulaca monacantha* and *Polycarpaea repens*. It has been observed in some *rodat*, when *Pennisetum divisum* grows as a common associate in the *Panicum* community, *Panicum* has been overgrazed, while *Pennisetum* is left without grazing. This may be a reason for the preponderance of *Pennisetum* in some stands.

5. ***Francoeuria crispa*** *community*

The dominant plant is an aromatic composite. The community occurs in shallow depressions with fine-textured sediments. Those depressions may be man-made, especially along roads. A few individuals of *Acacia tortilis*, *A. ehrenbergiana* or *Lycium shawii* may be recorded in some stands. The common associates include: *Fagonia bruguieri*, *Launaea nudicaulis*, *Cymbopogon parkeri*, *Trigonella stellata*, *Filago sparthulate*, *Astragalus tribuloides*, *Sclerocephalus arabicus*, *Atractylis carduus*, *Anastatica hierochuntica* and *Astragalus corrugatus*. In some stands, *Pulicaria undulata* was recorded.

This community is of widespread occurrence in Qatar, particularly in northern and central Qatar.

6. ***Zygophyllum quatarense*** *community* (Plate 4a)

Z. quatarense is one of the most common components of the flora of Qatar and contributes, to a great measure, to the vegetation of the country.

The community dominated by *Z. quatarense* has a wide ecological and sociological range. The associates vary in the northern stands from the southern ones.

This community abounds in shallow depressions on the rocky plateau, runnels crossing the Miocene ridges in southern Qatar. The habitat of this community is subjected to wind and water erosion. The soil is usually coarse-textured; however, the dominant plant accumulates fine deposits around its body forming a small mound. It is noteworthy to know that the plant cover in this community is open.

The common associates include: *Acacia tortilis*, *Lycium shawii*, *Francoeuria crispa*, *Heliotropium bacciferum*, *Scrophularia deserti*, *Euphorbia granulata*, *Anastatica hierochuntica*, *Aizoon canariense*, *Stipa capensis*, *Helianthemum lippii*, *Corchorus depressus*, *Glossonema edule*, *Launaea capitata*, *Trigonella stellata*, *Herniaria hemistemon*, *Aristida abnormis*, *Arnebia hispidissima* and *Tribulus terrestris*.

It is interesting to know that some associates occur only in stands in southern Qatar, e.g. *Panicum turgidum*, *Fagonia ovalifolia*, *Eleusine compressa*, *Convolvulus deserti*, *Polycarpaea repens* and *Cornulaca monacantha*.

7. ***Cornulaca monacantha*** *community*

This community occurs on deep sandy soils which are mainly deposited by wind. Two main localities are considered proper habitats for this community: (a) the sand accumulations west of Umm Bab; and (b) the sand accumulations in wide long runnels along the Emirates' road. It is to be noted that the main associates differ in these two localities. In the area west of Umm Bab, the main associates are: *Panicum turgidum*, *Moltkiopsis ciliata*, *Zypophyllum quatarense* and *Stipagrostis plumosa*. While in the area along the road to the United Arab Emirates, *Leptadenia pyrotechnica* becomes an important associate. Also, *Pennisetum divisum*, *Panicum turgidum*, *Zygophyllum quatarense* and *Indigofera articulata* occur in the latter area.

8. ***Hammada elegans*** *community* (Plate 10c)

The dominant plant is a desert succulent chenopod. The distribution of this community is restricted to south-west Qatar where sand accumulates along the road from Karaanah to Abu Samrah. Associated species include *Zygophyllum quatarense*, *Panicum turgidum*,

Suaeda vermiculata, Seidlitzia rosmarinus, Salsola vermiculata, Lasiurus hirsutus, Polycarpaea repens, Cornulaca monacantha, Cyperus conglomeratus and *Cistanche phelypaea.*

9. ***Pennistum divisum*** *community* (Plate 5b)

This community abounds in wadis and long runnels where the soil is mainly deposited by water. Soil supporting this community is deep and fine-textured. The tree layer is represented by *Acacia ehrenbergiana* on deep fine soils, *A. tortilis* on shallow coarse-textured soil along the margins of the community, *Lycium shawii* and *Leptadenia pyrotechnica.* Other associates include *Rhanterium epapposum, Zygophyllum quatarense, Cornulaca monacantha, Panicum turgidum* (usually grazed), *Stipogrostis plumosa, Indigofera articulata* and *Lasiurus hirsutus.*

10. ***Rhanterium epapposum*** *community* (Plate 14b)

This community is confined to sandy habitats in southern Qatar. It covers considerable areas along the road from Al-Wukair to Al-Kharrarah. Associated species include *Panicum turgidum, Pennisetum divisum, Eremopogon foveolatus, Acacia ehrenbergiana, Zygophyllum quatarense, Dipcadi erythreum* and *Cassia italica.*

11. ***Chrysopogon aucheri*** *community*

This community occurs in shallow runnels and rocky habitats. It has a wide geographical distribution in Qatar. Associated species vary from north to south Qatar. Among the associates may be mentioned: *Teucrium polium, Glossonema edule, Eremopogon foveolatus, Aristida meccana, Taverniera aegyptiaca, Scrophularia deserti, Euphorbia granulata, Helianthemum lippii* and *Stipagrostis plumosa.*

It is noteworthy to know that *Glossonema edule* may preponderate in some localities inhabited by this community.

HALOPHYTIC PLANT COMMUNITIES

1. ***Avicennia marina*** *community* (Plate 7c)

This community is represented by a dense pure population of *A. marina.* This plant may grow to 3 m. This community is confined to an area between Al-Khor and Dhakhira along the eastern coast of Qatar.

2. ***Arthrocnemum glaucum*** *community* (Plate 7d)

This community occurs on the saline flats along the coasts of Qatar, particularly to the north of Doha latitude. The habitat of this community is usually inundated during the high tide. Associates have low performance and include *Limonium axillare, Halocnemum strobiolaceum* and *Cistanche phelypaea.*

3. ***Halocnemum strobiolaceum*** *community* (Plate 8d)

It occupies the salt marshes along the coasts of Qatar, but with more wide distribution than the above-mentioned community. Its habitat is not frequently inundated with sea water. Associates include *Arthrocnemum glaucum, Halopeplis perfoliata, Salsola soda* and *Aeluropus lagopoides.*

4. ***Halopeplis perfoliata*** *community* (Plate 9a)

This community occurs on sand beaches along the shore. The dominant plant forms mounds. Associated species are *Salsola vermiculata*, *Halocnemum strobiolaceum*, *Anabasis setifera* and *Zygophyllum quatarense*.

The habitat of this community is not inundated with sea water.

5. ***Suaeda vermiculata*** *community* (Plate 9d)

The dominant plant, known locally as *Suwweid*, is grazed by camels. It forms sizeable mounds of fine-textured soil and material. The community has a limited distribution in Qatar, i.e. in the south-western corner of the country.

Associates include *Aeluropus lagopoides*, *Seidlitzia rosmarinus*, *Salsola baryosma*, *Sporobolus arabicus* and *Salsola cyclophylla*.

6. ***Limonium axillare*** *community* (Plate 9b).

The dominant salt-secreting plant is of widespread occurrence in the salines of Qatar. Soils supporting the *Limonium* community are coarse-textured, but the mounds formed by the dominant plant are of finer material. The habitat of this community is not inundated by sea water.

Associates are *Zygophyllum quatarense*, *Anabasis setifera*, *Cistanche phelypaea*, *Sporobolus arabicus* and *Suaeda vermiculata*.

7. ***Aeluropus lagopoides*** *community*

The dominant plant is a grass with widespread distribution in the coastal marshes of Qatar. The community occurs on saline flats with fine-textured soil. Usually it is found in the form of a pure population of the dominant plant.

8. ***Halopyrum mucronatum*** *community*

This community has a particular distribution in Qatar, being confined to the coastal beach in south-western Qatar. The dominant plant forms sizeable mounds. The plant cover reaches 60%. Associates grow among the mounds and are represented by *Sporobolus arabicus*, *Suaeda vermiculata*, *Launaea nudicaulis*, *Salsola baryosma* and *Cressa cretica*.

9. ***Sporobolus arabicus*** *community*

The community occurs in saline depressions, runnels leading to the Gulf as well as salinized land. The habitat of this community is subjected to wind and water erosion, hence coarse lag material occurs on the ground surface. Associates include *Limonium axillare*, *Zygophyllum quatarense* and *Atriplex leucoclada*.

HUMAN ACTIVITIES AND ENVIRONMENT

Prior to the oil production, Qatar was a very sparsely settled country. The permanent settled population at that time was estimated to have been about 25,000. Members of various tribal groups, whose origin may be traced to the Najd region of Saudi Arabia settled in the northern coastal areas. In the southern part of the country there were nomadic groups who pursued an alternating transhumance with the interior of Saudi Arabia. During that period the human impact on the environment and its components was not drastic. Grazing, fishing and searching for pearls and the limited agricultural practices were not imposing remarkable changes on the environment. Water was obtained from hand-dug wells without severe exploitation of the resources. Motoring through the desert was not so common as nowadays, a practice causing an obvious deterioration of the soil and plant cover. However, the water scarcity was a prominent factor in human life. Natives suffered greatly due to the scarcity of natural resources and lack of capital and technology to make use of these resources.

Discovery and exploitation of oil exhibited considerable consequences. Oil production in 1949 in Qatar was the first economic and industrial development on any appreciable scale in the history of the country (Plate 13a). Production increased sharply from 80,307 tons in 1949 to 1,616,598 tons in 1950. It showed an almost five-fold increase in the first 10 years of production (Fig. 11). The maximum production was 26,994,704 tons in 1973.

Oil revenues exhibit a continuous increase since 1949. The available data during the seventies show that the revenues increased from 109 million U.S.$ in 1970 to 409 million U.S.$ in 1973. The revenues showed an amazing rise in 1974 after the Middle East war in October 1973; reaching 1,401 million U.S.$ in 1974. Despite the decline of oil production in 1975 and 1976, the revenues increased, being 2,116 million U.S.$ in 1976.

Wealth accruing from oil exploitation has its clear effect on different aspects of man and his environment and results in rapid socio-economic changes. These changes—which include rapid economic development, rise in income and standard of living, migration of the rural labour force into the urban areas and influx of expatriate labour and entrepreneurs—have combined to exert heavy pressure on public utilities and municipal services in urban areas in spite of a substantial expansion in the last years. One of the main consequences of these factors is the rapidly increasing potable water demand. Due to the vast undertakings in the fields of health, education, communication, housing, agricultural improvement, development of water resources, the man–environment relationships have become of crucial importance in Qatar. The ever-changing landscape, as a result of oil fields, road construction, housing and industrialization, emphasizes the importance of studying the relationship between man and his environment in Qatar. The human impact in the different parts of the country is very prominent with man-induced hazards.

The government is promoting the development of other resources to lessen the dependence on oil, whose revenues represent 90–95% of the total revenues of Qatar, and create a more balanced economic structure. The government embarked on inventory planning

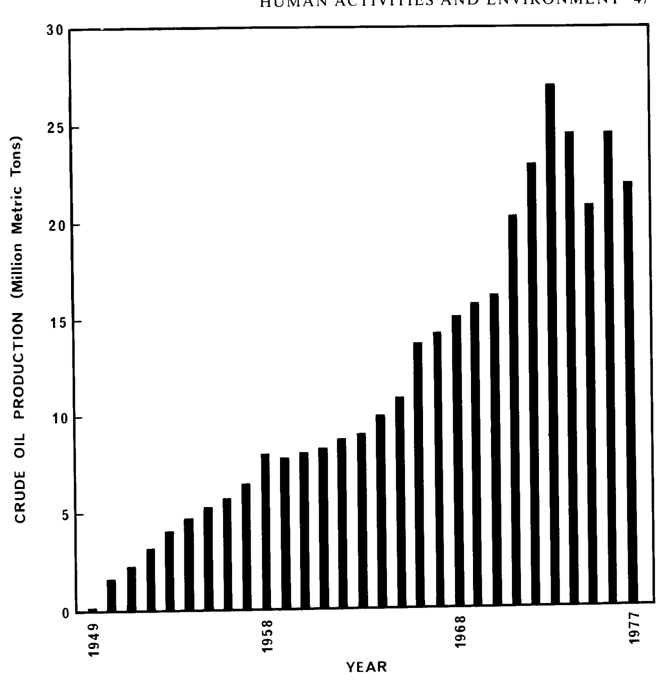


Fig. 11. Crude oil production in Qatar during 1949–77.

and feasibility studies during the last decade. The primary stress continues to be on removing the problem of water scarcity, which remains one of the most serious constraints to development, especially agricultural development.

It is not intended to enumerate the impacts of human activities, resulting from the rapid socio-economic changes, on all the components of the environment. Activities and practices related to the plant life are discussed here.

AGRICULTURE

Agriculture is confined to some of the *rodat* depending on the groundwater (Plates 2a;

13b). The *rodat* occupy an area of 27,620 ha or 2·44% of the land surface of the peninsula of Qatar. On the other hand, the area of cultivated *rodat* amounts to 1,786 ha with an average net crop area per farm of 6·6 ha. The number of farms increased in the last decade, but with fluctuations. In 1975/76, the number was 270; almost half of them in northern Qatar.

The farming system in the cultivated *rodat* varies from north to south, depending on the water quality and soil conditions. Three main farming systems are recognized; vegetable farming mainly in northern Qatar (Plate 13c) vegetable–orchard–forage farming in northern and central Qatar, and orchard–forage farming in central and southern Qatar.

Agriculture is by far the largest consumer of water in Qatar. Surveys of farm water extraction in 1972/73 and 1976 show that the net extraction of water increased during this period at a rate of about 7·5% per annum. The net extraction increased from 35·3 million cubic metres in 1973 to 43·2 million cubic metres in 1976. During the same period the number of farms has in fact decreased but there is evidence that while farms have been abandoned (Plate 13d), the intensity of irrigation on the remainder has increased. Exploitation of groundwater by modern drilling spread quickly in the last decade. The hasty drilling and uncontrolled extraction from many wells created many problems; the consequences are widespread and affect all land resources. In southern Qatar, the data obtained from over 100 wells since 1971 show an increase of 22% in total dissolved solids (UNDP/FAO, 1977). This indicates the continued overdraft of the groundwater reservoir and encroachment of brackish and salt water from the coastal margins. The overall groundwater balance of Qatar exhibits an annual average deficit of $-26 \times 10^6 m^3$ or in excess of the annual recharge by 82%. It has been assumed that overall water levels will continue their present decline at a rate of 0·1 m per annum in response to the present withdrawal rate and serious salinity problems will arise.

PASTORALISM

Nomadic pastoralism has been the traditional form of land-use practices in Qatar for many years before oil exploitation. Nomadic groups in the southern part of the country pursued an alternating transhumance with the interior of Saudi Arabia. However, since the start of the oil industry, the number of nomads decreased progressively. Raising animals on farms and growing alfalfa (*Medicago sativa*) are practiced these days. During spring many herds of camels, sheep and goats are grazing the naturally growing plants in the desert (Plates 14a, b).

The natural vegetation, though sparse, comprise many palatable species, e.g. *Panicum turgidum, Rhanterium epapposum, Eleusine compressa* as well as numerous annual plants. Appearance of annuals is unpredictable due to irregularity of rainfall. Hence some of the palatable perennials, particularly *Panicum turgidum* and *Eleusine compressa* have been overgrazed. Stunted growth and the creeping habit of the overgrazed plants help in serious soil erosion and modification of runoff. In some parts, the surface soil becomes more compact as a result of trampling, consequently the infiltration rate decreases and water moves over the soil rather than penetrating into it.

The lack of cultivated fodder aggravates the problem. However, fair development has been made in the cultivation of alfalfa. Cultivation of introduced *Atriplex* sp. has been

carried out in Abu Samrah farm in southern Qatar, where water contains high values of soluble salts

EFFECTS OF HUMAN ACTIVITIES ON THE PLANT LIFE

1. Though the cultivated area in Qatar is limited, agricultural practices have resulted in the appearance of a considerable number of weeds. Common weeds in Qatar include: *Chenopodium murale*, *Convulvulus arvensis*, *Cynodon dactylon*, *Polypogon monospliensis*, *Amaranthus graecizans*, *Phalaris paradoxa*, *Melitotus albus*, *M. indicus*, *Malva pariflora*, *Sonchus oleraceus* and *Euphorbia prostrata*.

2. Salinization of the soil due to faulty irrigation resulted in the appearance of plants with halophytic affinity in the farms, e.g. *Cressa cretica*, *Schanginia aegyptiaca*, *Salsola baryosma* and *Sporobolus spicatus*.

3. Fencing the *rodat* has protected numerous species, particularly palatable species. This case has been observed in Al-Wabrah, where good growth of *Ochradenus baccatus* and *Ephedra foliata* occurs. *Cocculus pendulus* has been recorded only in Al-Wabrah and Al-Kharrarah, where the two *rodat* were protected. Rare species such as *Astragalus hamosus* and *Salanum eleangifolium* were recorded only at Al-Wabrah.

4. Continuous spilling of water in some farms resulted in the growth of *Typha domingensis* (Plate 14c), *Scirpus tuberosus* and *Lippia nodiflora*.

5. Discharge of sewage in considerable amounts to the south of Doha resulted in the dense growth of *Phragmites australis* covering vast areas (Plate 14d). Spilling of effluent water in the desert caused a considerable growth of weeds, mainly *Chenopodium murale*, *Portulaca oleracea* and *Solanum nigrum*.

6. Construction of roads resulted in the removal of the natural plant cover from vast areas. However, the government started afforesting considerable areas along the roads. *Acacia nilotica* subsp. *indica* is being cultivated using the drip irrigation method (Plate 15a). This practice initiated the growth of many weeds in the hollows supporting the *Acacia* trees.

7. Digging out sediments from the *rodat* supporting *Ziziphus nummularia* results in the deterioration of the habitat and evident changes of the kind of species growing therein (Plate 15b). This has been recently forbidden by law. Removal of stones and digging shallow holes in the *hozoom* creates a favourable habitat for the growth of ephemerals, e.g. *Zygophyllum simplex* (Plate 15c). Man-made depressions beside the roads may be occupied by a dense growth of *Francoeuria crispa* after accumulation of fine sediments.

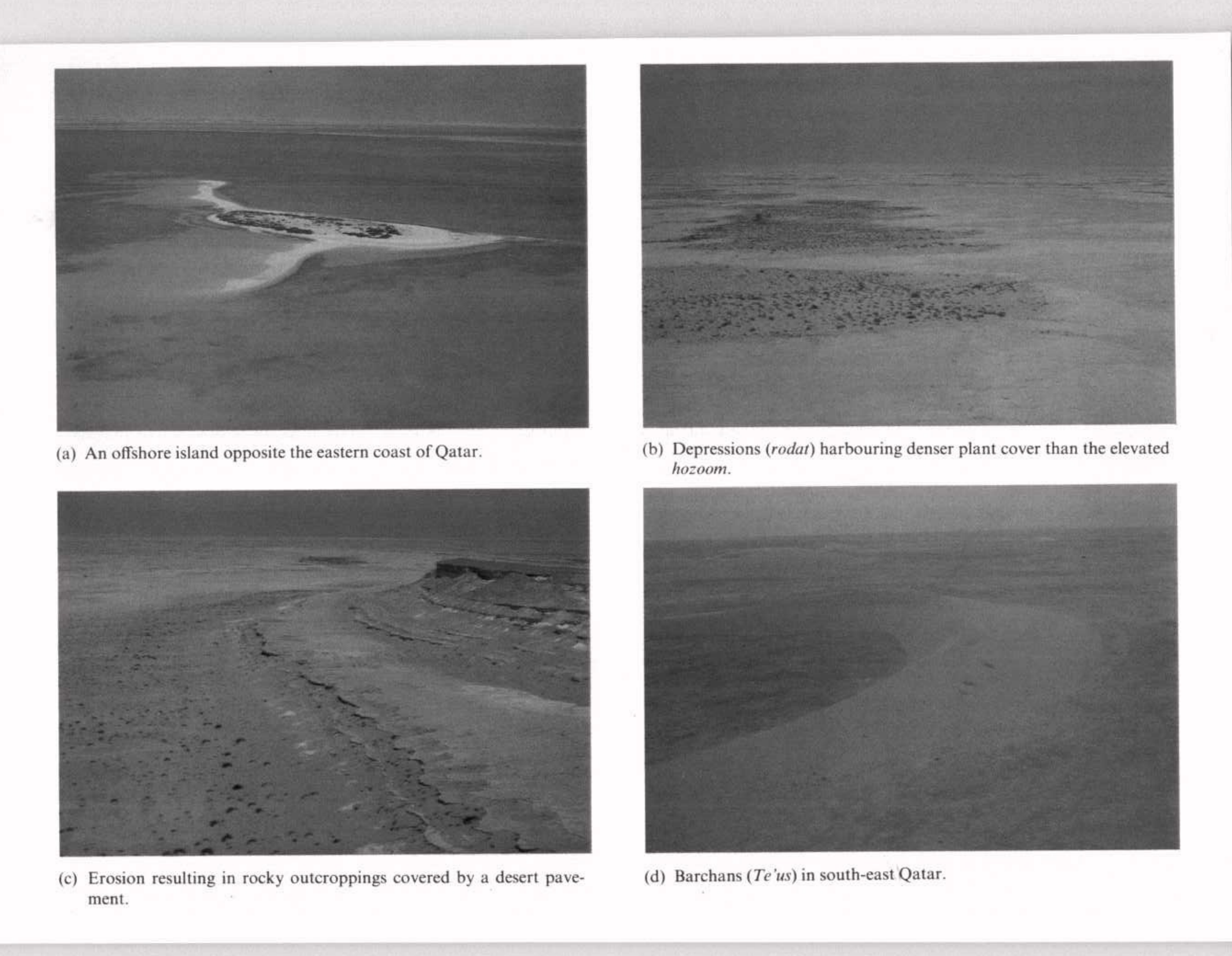
8. Following non-proper agricultural practices under desert conditions causes the deterioration of the cultivable land. Hence farms are abandoned. These farms support plants different from those originally present before agriculture was practised. The change depends on the reason of the failure of agriculture, e.g. due to salinization, lack of water or formation of hard pans.

9. Motoring and motor transport activities result in the removal of vegetation from vast areas and enhance erosion. Those processes result in the establishment of desert pavement with gravel-strewn surfaces in some places which become devoid of plant cover.

10. Grazing of *Acacia* trees by camels results in their stunted growth. In protected areas or fenced *rodat*, the trees of *A. tortilis* acquire considerable heights.

11. Many trees have been cultivated in Doha streets and irrigated regularly with sewage water. This practice has eventually changed the landscape of the city. Among those trees may be mentioned: *Prosopis juliflora*, *Ficus nitida*, *Albizzia lebbeck*, *Ficus elastica* and *Bauhinia variegata*. Irrigation of these trees and the lawns initiated the widespread occurence of many weeds.

In private gardens at Doha, or in the cultivated *rodat*, there are many other trees, either fruit or ornamental, e.g. *Laswonia inermis*, *Sesbania sesban*, *Ziziphus mauritiana*, *Z. spina-christi*, *Casuarina* sp., *Morus nigra*, *Phenoix dactylifera*, *Ficus carica*, *Citrus* spp., *Parkinsonia aculeata*, *Delonix regia*, *Caesalpinia gilliesii*, *Pithocellobium dulce*, *Psidium guajava*, *Punica granatum*, *Vitis venifera* and *Terminalia caddaba* (Plates 15d, 16a, b, c, d). Ornamental shrubs and herbs are widely cultivated in Doha.



(a) An offshore island opposite the eastern coast of Qatar.

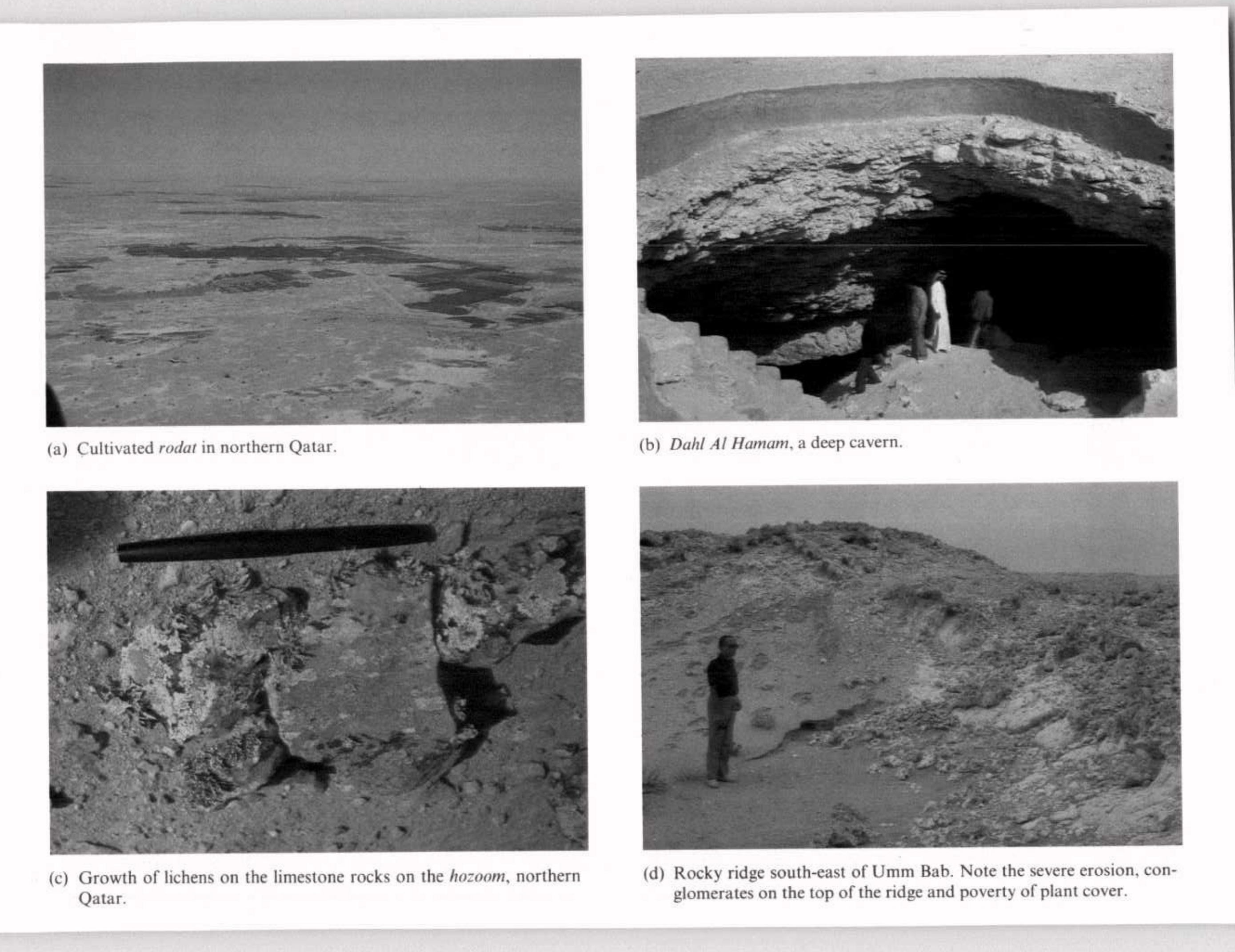
(b) Depressions (*rodat*) harbouring denser plant cover than the elevated *hozoom*.

(c) Erosion resulting in rocky outcroppings covered by a desert pavement.

(d) Barchans (*Te'us*) in south-east Qatar.

PLATE 1

Plate 2



(a) Cultivated *rodat* in northern Qatar.

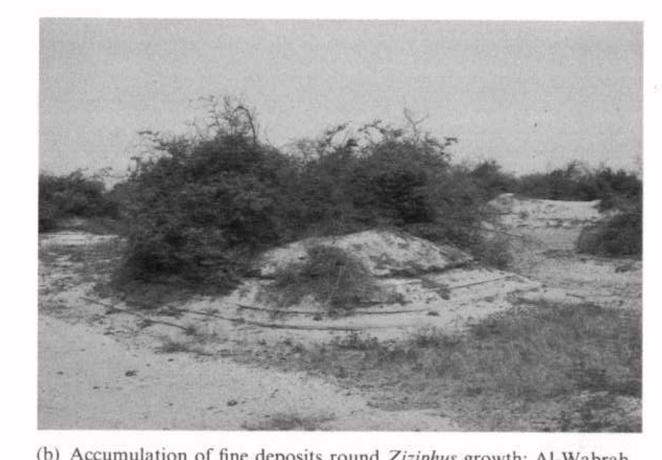
(b) *Dahl Al Hamam*, a deep cavern.

(c) Growth of lichens on the limestone rocks on the *hozoom*, northern Qatar.

(d) Rocky ridge south-east of Umm Bab. Note the severe erosion, conglomerates on the top of the ridge and poverty of plant cover.



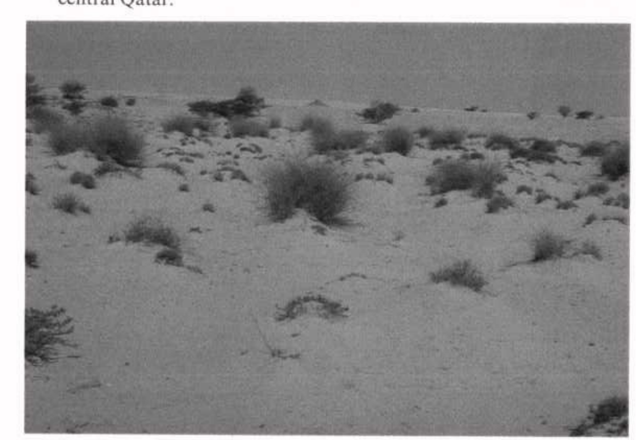
(a) *Roda* in central Qatar with a growth of *Ziziphus nummularia*.



(b) Accumulation of fine deposits round *Ziziphus* growth; Al-Wabrah, central Qatar.

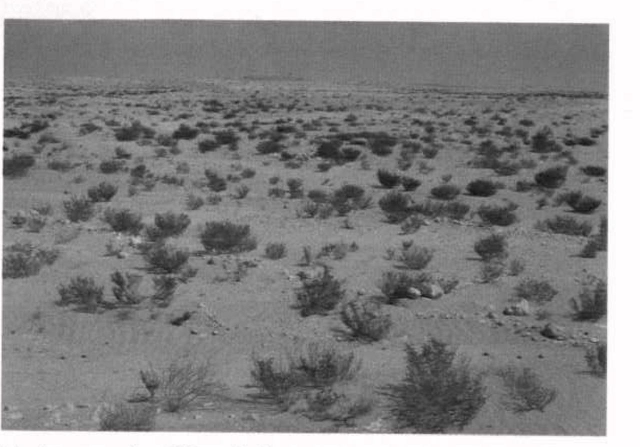


(c) *Roda* near Al-Suwairiyah, northern Qatar supporting *Cymbopogon parkeri* community. Note the dense ephemeral growth, mainly of *Stipa capensis*.



(d) *Pennisetum divisum* (ungrazed) and *Panicum turgidum* (grazed) in a depression, south-west Qatar near Kara'anah.

PLATE 3



(a) A community of *Zygophyllum quatarense* in wind-eroded habitats, southern Qatar.



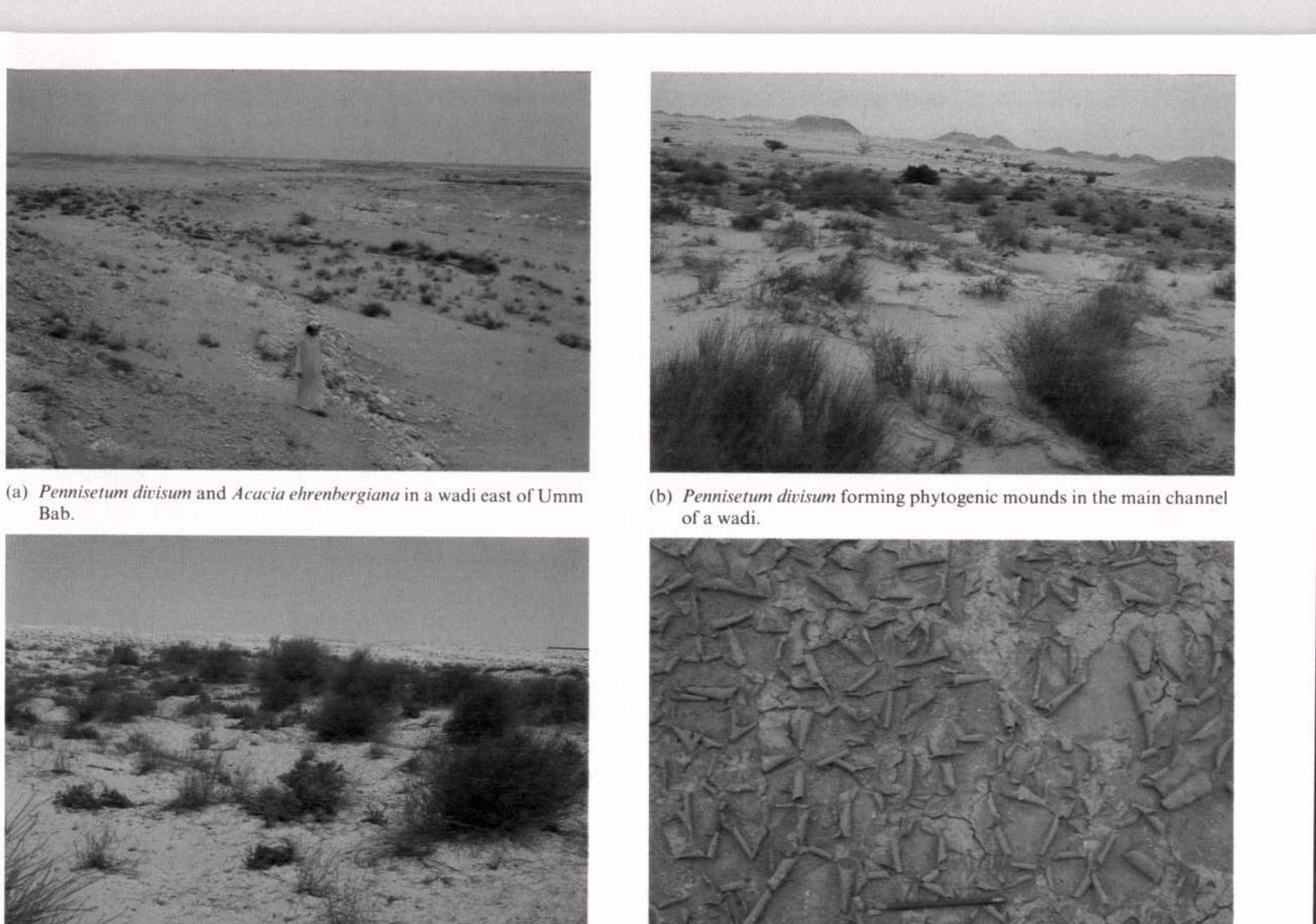
(b) Dense ephemeral growth in a shallow depression after heavy rains, northern Qatar.



(c) *Ziziphus nummularia* tree, with *Cocculus pendulus* climbing on it in a protected *Rodah*; Al-Kharrarah, southern Qatar.



(d) A high *Acacia tortilis* tree in a formerly protected cultivated *roda*; Umm Slal Mohammed, northern Qatar.



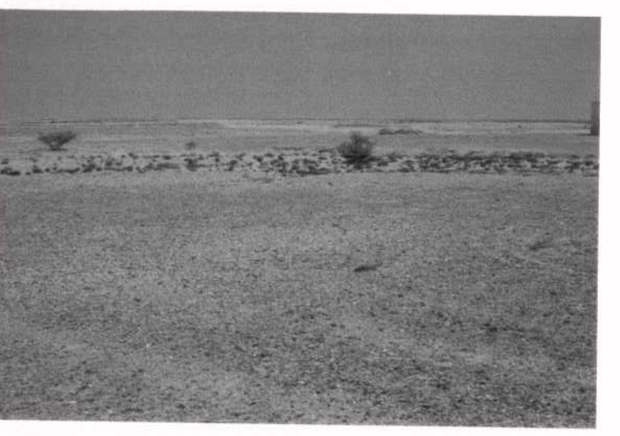
(a) *Pennisetum divisum* and *Acacia ehrenbergiana* in a wadi east of Umm Bab.

(b) *Pennisetum divisum* forming phytogenic mounds in the main channel of a wadi.

(c) *Leptadenia pyrotechnia* shrubs and *Panicum turgidum* on deep sandy soil.

(d) Rolled thin clay crusts in the main channel of a wadi.

Plate 6



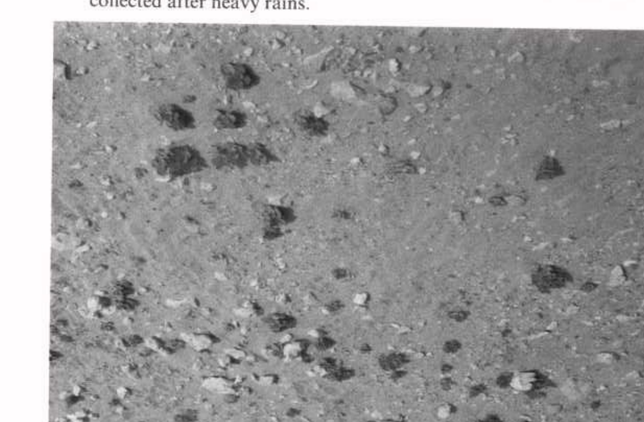
(a) A long runnel crossing the sterile desert pavement on the top of Miocene ridges, southern Qatar.



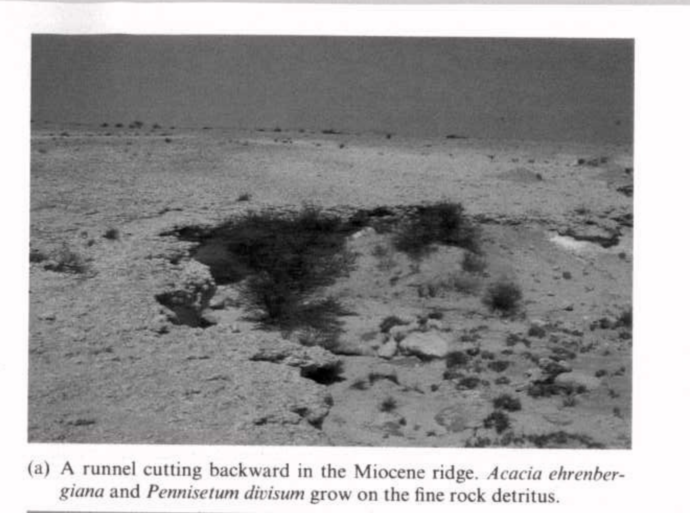
(b) The downstream of a long runnel dissecting the top of Miocene ridges, southern Qatar. Note the stones on its bottom and water collected after heavy rains.



(c) A runnel dissecting the plateau and draining towards the western shore opposite Hwar island. *Limonium axillare* and *Sporobolus arabicus* dominate the plant cover.



(d) A bed of a short runnel covered with stones and gravel, supporting *Glossonema edule*.

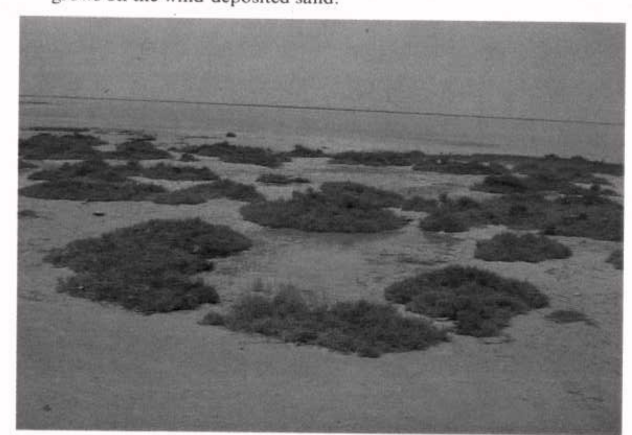


(a) A runnel cutting backward in the Miocene ridge. *Acacia ehrenbergiana* and *Pennisetum divisum* grow on the fine rock detritus.



(b) A runnel cutting backward in the Miocene ridge. *Panicum turgidum* grows on the wind-deposited sand.

(c) *Avicennia marina* on the mud flats along the eastern coast opposite Dhakhira.

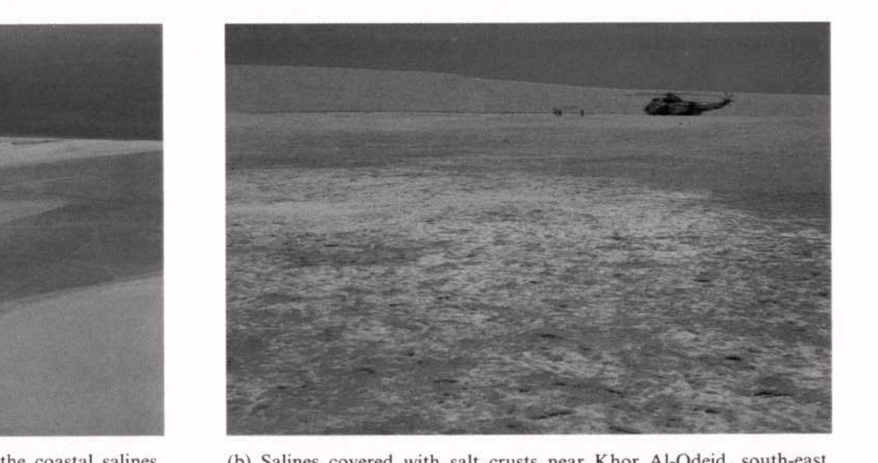


(d) *Arthrocnemum glaucum* on the coastal salines near Dhakhira.

PLATE 7



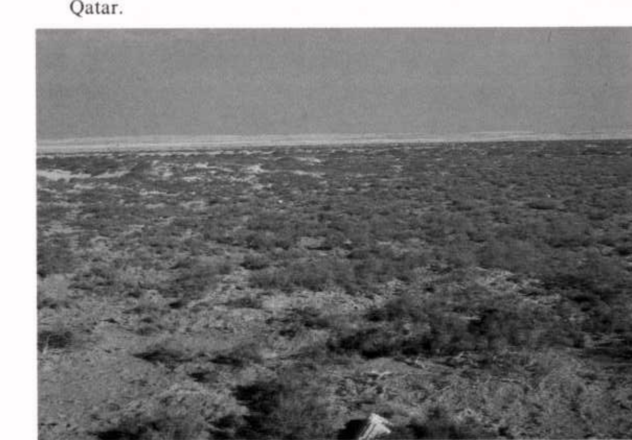
(a) Crescentic sand dunes (barchans) encroaching the coastal salines south of Umm Said.



(b) Salines covered with salt crusts near Khor Al-Odeid, south-east Qatar.

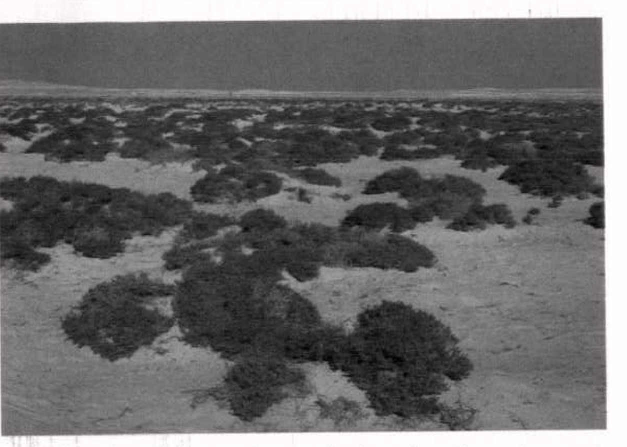


(c) Gypsum crystals on the ground surface near Khor Al-Odeid, south-east Qatar.

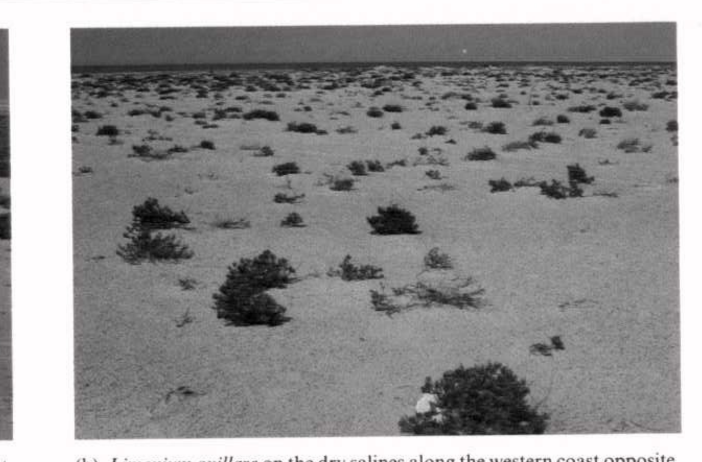


(d) *Halocnemum strobiolaceum* on salines bordering the sabkha east of

PLATE 9



(a) *Halopeplis perfoliata* on the coastal salines along the western coast near Abu Samrah.



(b) *Limonium axillare* on the dry salines along the western coast opposite Abu Samrah.



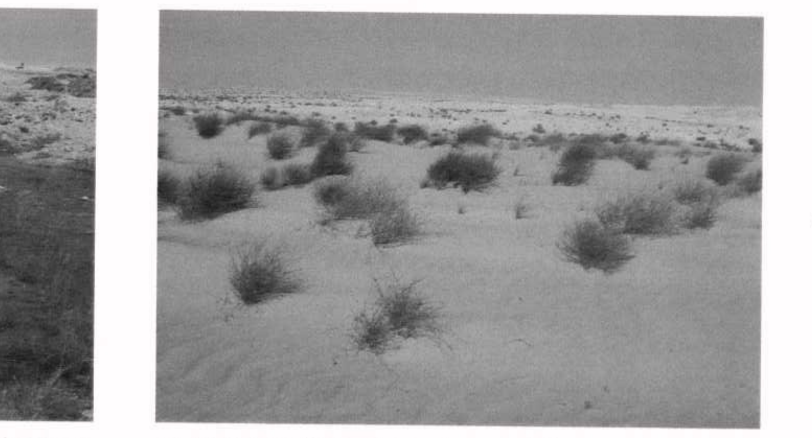
(c) *Phoenix dactylifera* on the coastal salines opposite Umm Bab.



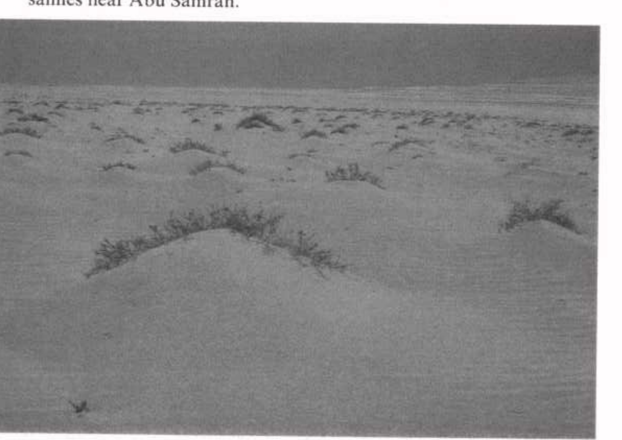
(d) *Suaeda vermiculata* (grazed) forming sizeable phytogenic mounds.



(a) *Cyperus laevigatus* growing in hollows filled with water in the coastal salines near Abu Samrah.



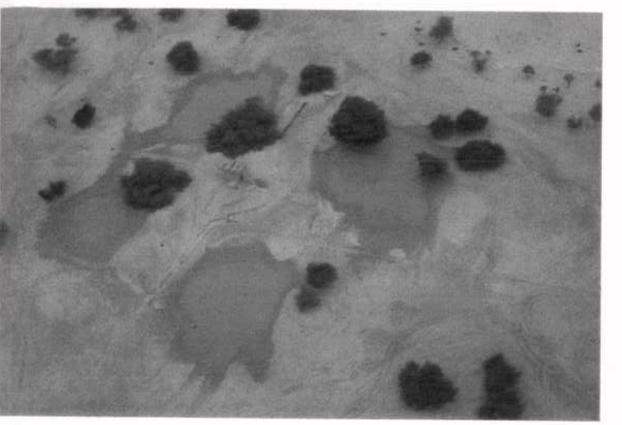
(b) *Panicum turgidum* on deep sandy accumulations.



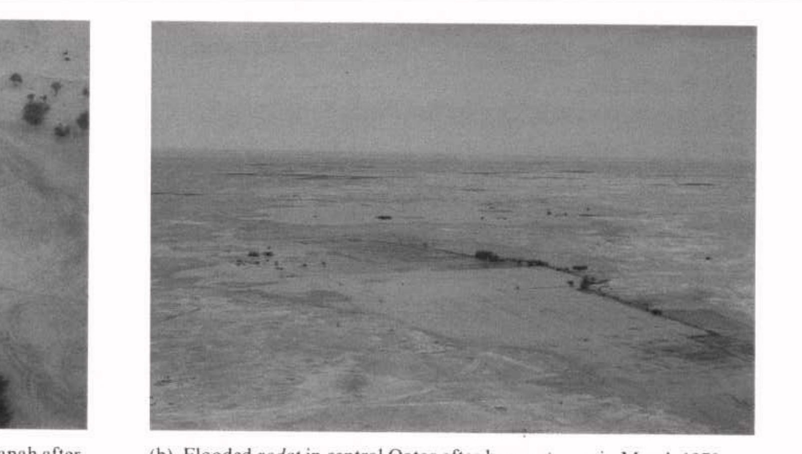
(c) *Hammada elegans* on deep sandy soil, south Kara'anah.



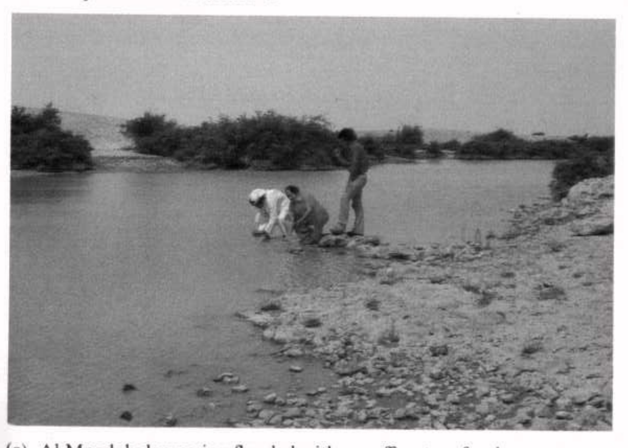
(d) *Cyperus conglomeratus* on the sides of a barchan, southern Qatar.



(a) Accumulated runoff water in the depressions west of Kara'anah after heavy storms in March 1979



(b) Flooded *rodat* in central Qatar after heavy storms in March 1979.



(c) Al Magdah depression flooded with runoff water after heavy storms in March 1979



(d) Shallow depression collecting runoff water after heavy storms in March 1979.

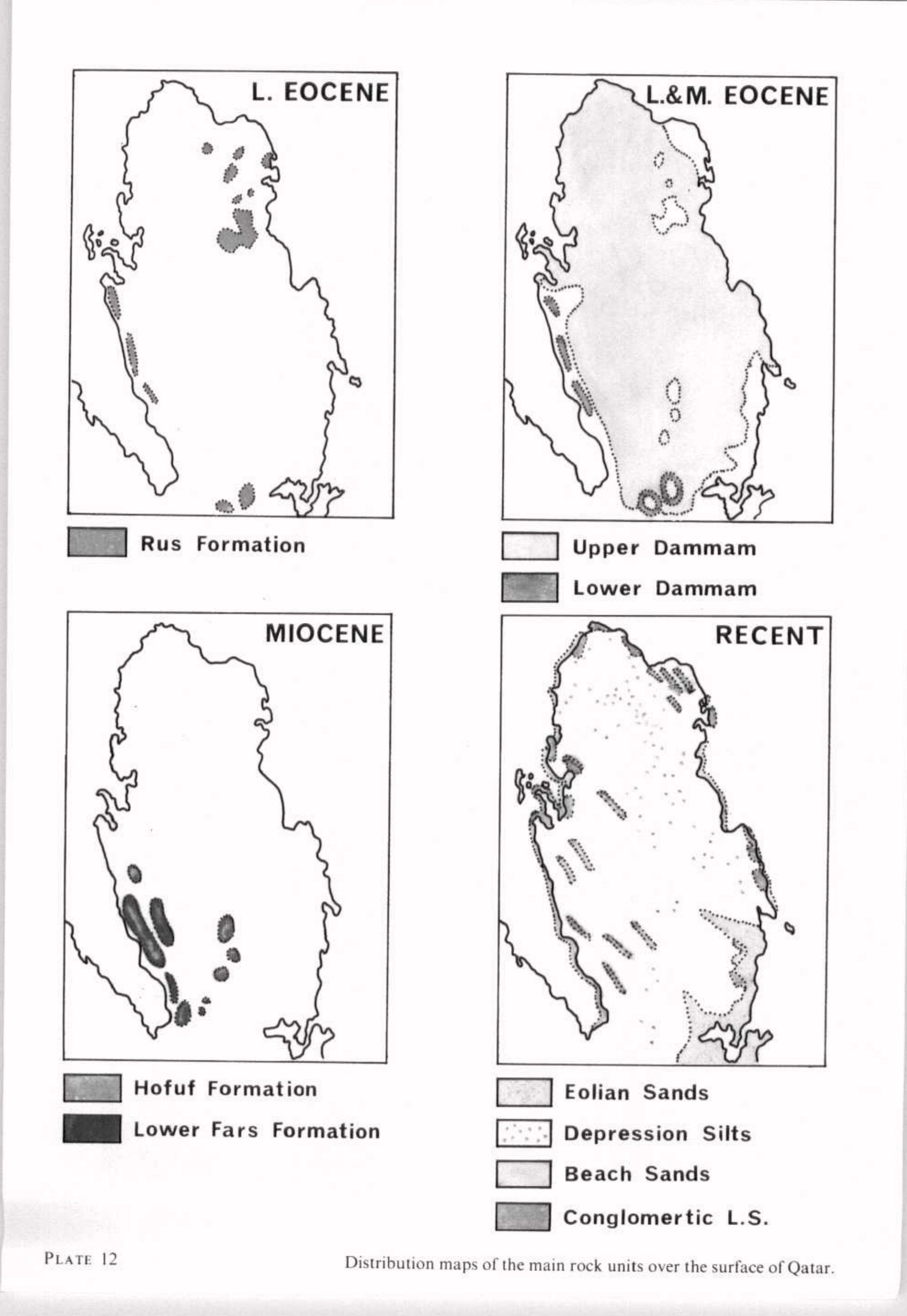
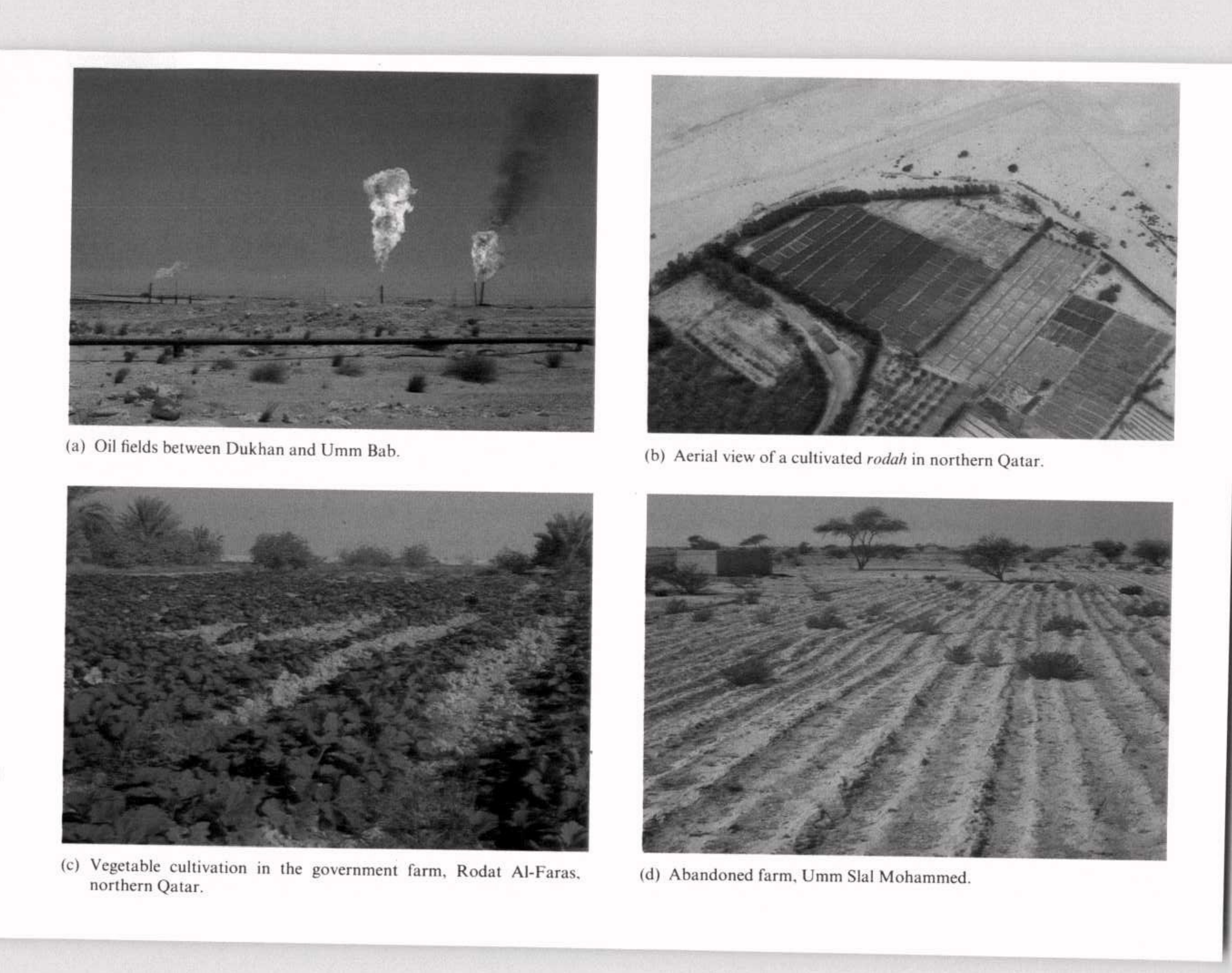


PLATE 12 Distribution maps of the main rock units over the surface of Qatar.



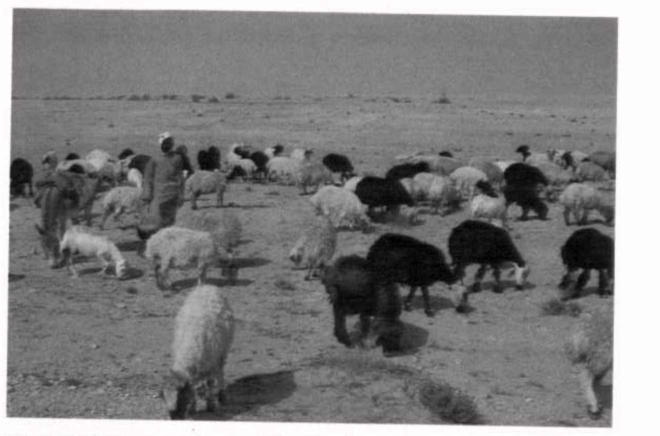
(a) Oil fields between Dukhan and Umm Bab.

(b) Aerial view of a cultivated *rodah* in northern Qatar.

(c) Vegetable cultivation in the government farm, Rodat Al-Faras, northern Qatar.

(d) Abandoned farm, Umm Slal Mohammed.

PLATE 14



(a) Herd of sheep grazing near Kara'anah, south-west Qatar.



(b) A camel grazing *Rhanterium epapposum* (*Arfaj*) between Al-Wukair and Al-Kharrarah.



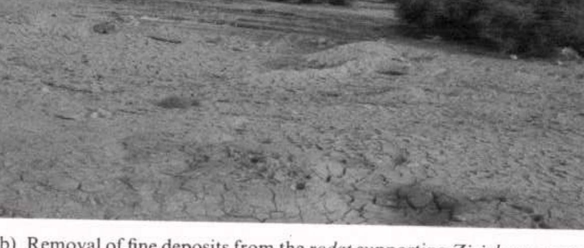
(c) Growth of *Typha domingensis* resulting from continuous spilling of water, Ras Ushirij.



(d) Dense growth of *Phragmites australis* covering a vast area south of Doha as a result of discharging sewage.

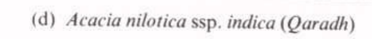


(a) Afforestation along the road from Doha to northern Qatar, *Acacia nilotica* ssp. *indica*.

(b) Removal of fine deposits from the *rodat* supporting *Ziziphus nummularia*.

(c) Ephemeral growth of *Zygophyllum simplex* in a man-made hollow on a *hazm*.



(d) *Acacia nilotica* ssp. *indica* (*Qaradh*)

PLATE 16



(a) *Lawsonia inermis* l. (*Henna*)

(b) *Citrus sinensis* L. (*Bortoqual*)

(c) *Ficus carica* l. (*Teen*)

(d) *Parkinsonia aculaeta* L. (*Aqrab*)

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PART TWO
FLORA



SYSTEM FOLLOWED

For the arrangement of orders and families, we have adopted the system of A. Engler, *Syllabus der Pflanzenfamilien* (12th edition by Hans Melchior, 1964). Due to limited number of genera in the majority of the families treated, as well as limited number of species in the various genera, we found it better to arrange the genera and the species of each family alphabetically.

Orders and families dealt with in this part are given below:

A. Division **GYMNOSPERMAE**
Class **Chlamydospermae**
Order ***Gnetales***
Ephedraceae
B. Division **ANGIOSPERMAE**
I. Class **Dicotyeldoneae**
1. Subclass **Archichlamydeae**
Perianth of free parts or absent
1. Order ***Urticales***
Urticaceae
2. Order ***Polygonales***
Polygonaceae
3. Order ***Centrospermae***
1. Suborder ***Phytolaccineae***
Molluginaceae, Aizoaceae
2. Suborder ***Portulacineae***
Portulacaceae
3. Suborder ***Caryophyllineae***
Caryophyllaceae
4. Suborder ***Chenopodiineae***
Chenopodiaceae, Amaranthaceae
4. Order ***Ranunculales***
Suborder ***Ranunculineae***
Menispermaceae
5. Order ***Papaverales***
1. Suborder ***Papaverineae***
Papaveraceae
2. Suborder ***Capparineae***
Capparaceae, Cleomaceae, Cruciferae
3. Suborder ***Resedineae***
Resedaceae

6. Order ***Rosales***
1. Suborder ***Rosinaea***
Neuradaceae
2. Suborder ***Leguminosineae***
Leguminosae
7. Order ***Geraniales***
1. Suborder ***Geraniineae***
Oxalidaceae, Geraniaceae, Zygophyllaceae
2. Suborder ***Euphorbiineae***
Euphorbiaceae
8. Order ***Rutales***
1. Suborder ***Rutineae***
Rutaceae
2. Suborder ***Polygalineae***
Polygalaceae
9. Order ***Rhamnales***
Rhamnaceae
10. Order ***Malvales***
Suborder ***Malvineae***
Tiliaceae, Malvaceae
11. Order ***Violales***
1. Suborder ***Cistineae***
Cistaceae
2. Suborder ***Tamaricineae***
Tamaricaceae, Frankeniaceae
12. Order ***Cucurbitales***
Cucurbitaceae
13. Order ***Myrtiflorae***
Suborder ***Cynomoriineae***
Cynomoriaceae
14. Order ***Umbelliflorae***
Umbelliferae

2. Subclass **Sympetalae**

Perianth of united parts, at least the corolla
1. Order ***Primulales***
Primulaceae
2. Order ***Plumbaginales***
Plumbaginaceae
3. Order ***Gentianales***
Gentianaceae, Asclepiadaceae, Rubiaceae
4. Order ***Tubiflorae***
1. Suborder ***Convolvulineae***
Convolvulaceae, Cuscutaceae
2. Suborder ***Boraginineae***
Boraginaceae

3. Suborder ***Verbenineae***
Verbenaceae, Avicenniaceae, Labiatae
4. Suborder ***Solanineae***
Solanaceae, Scrophulariaceae, Acanthaceae, Orobanchaceae
5. Order ***Plantaginales***
Plantaginaceae
6. Order ***Campanulales***
Compositae
II. Class **Monocotyledoneae**
1. Order ***Helobiae***
Suborder ***Hydrocharitineae***
Hydrocharitaceae
2. Order ***Liliflorae***
Suborder ***Liliineae***
Liliaceae
3. Order ***Juncales***
Juncaceae
4. Order ***Graminales***
Gramineae
5. Order ***Principes***
Palmae
6. Order ***Pandanales***
Typhaceae
7. Order ***Cyperales***
Cyperaceae

GYMNOSPERMAE

1. EPHEDRACEAE *DUM.*

Much branched, erect or sprawling shrubs or woody climbers; branches greenish, equisetoid, not resinous; leaves opposite or whorled, connate towards base, reduced to membraneous sheaths or scales. Inflorescence dioecious. Male cones solitary or clustered at a node or on short lateral branches. Female cones with several pairs or whorls of bracts surrounding 1–3 ovules. Fruit coriaceous or fleshy, berry-like; seed with 2 cotyledons. One genus only.

EPHEDRA L.

Leafless or sparingly leafy, erect or sprawling shrubs or woody climbers. Dioecious (monoecious in our species) plants. Leaves small, opposite; the nodes with short sheaths. Flowers in small spikes, the female 2-flowered developing into a fleshy, berry-like (in our

species) or dry, cone-like fruit. Male spikes with small, naked flowers in the axils of imbricated bracts, filaments joined into a column.

1. ***Ephedra foliata*** *Boiss. ex C. A. Mey.*, Versuch. Monogr. Ephedra, in Mem. Acad. Imp. Sc. Petersb. 4: 107 (1846); Boiss., Diagn. Ser. 1, 7: 101 (1847), Fl. Orient. 5: 716 (1884); Stapf. in Denkschr. Mat-nat. Kl. Akad. Wiss. Wien 56: 49 (1889); Täckh. et Drar, Fl. Egypt 1: 83 (1941).

E. ciliata C. A. Mey., l.c. 100 (1846); Fl. U.R.S.S. 1: 198 (1934); Rech., Fl. Iranica, *Ephedraceace* 3 (1963); Rech. f., Fl. Lowland Iraq 24 (1964). *E. polylepis* Boiss. et Hausskn., in Fl. Orient. 5: 716 (1884). *E. peduncularis* Boiss. et Hausskn., l.c. 716 (1884). *E. foliata* var. *ciliata* (Fisch. et Mey.) Stapf., l.c. 49 (1889); Hand.-Mazz., in Ann. Naturh. Mus. Wien 26: 127 (1912). *E. foliata* var. *polylepis* (Boiss. et Hausskn.) Stapf., l.c. 50 (1889); Anth., Notes Roy. Bot. Gard. Edin. 6, 18: 303 (1935).

Shrub up to 2 m tall, usually climbing. Branches narrow and flexible. Leaves filiform, varying in length from a few to 20 mm. Male cones at the tips of slender branches, either singly or in 3. Female cones 6–7 mm long and 5–6 mm wide, at the tips of slender branches often more than 3 cm long, the bracts united in pairs or whorls of 3 to form 3–4 ovules of which the 2 inner become fleshy at maturity and the innermost is more than twice as long as that next outside it. Berries white, red, or flesh coloured.

In the *rodat* (depressions) of northern and central Qatar, often ascending in *Ziziphus nummularia* bushes. Its growth in these bushes protects it from grazing by camels; however, protruding branches are usually trimmed by camels. Flowering in April (Plate 17).

ANGIOSPERMAE

DICOTYLEDONEAE

2. *URTICACEAE A. JUSS.*

Herbs (ours) with simple, alternate or opposite leaves. Flowers minute, regular, mostly unisexual, arranged in whorled racemes or spikes or globular clusters. Perianth simple, sepaloid, of 4–5 segments. Stamens as many as the perianth segments and opposite them, bent inwards in bud and exploding when ripe. Ovary 1-loculed, superior, 2-carpelled. Fruit in ours an achene invested in the perianth.

I. Leaves entire, exstipulate . . . . . . 2. *Parietaria*
II. Leaves serrate, stipulate.
 1. Leaves alternate without stinging hairs . 1. *Forsskohlea*
 2. Leaves opposite with stinging hairs . . 3. *Urtica*

1. *FORSSKOHLEA* L.

Slender herbs with alternate, serrate, not stinging, trinerved leaves, wooly on the under surface. Flowers unisexual, crowded in sessile or subsessile clusters in the leaf axils, surrounded by an involucre of 4–6 fleecy leaves. Perianth of fertile female flowers absent. Male flowers with 3-toothed calyx and 1 stamen, calyx tubular, 1-lipped. Fruit achene, enclosed in the involucre.

1. *Forsskohlea viridis* *Ehr. ex Webb.* ap. Hook.; Täckh., Stud. Fl. Egypt, ed. 2, 57 (1974); Migahid, Fl. Saudi Arab., Ed. 2, 1: 194 (1978).

Annual herb with soft branches. Leaves green on the lower surface, white on the upper. Calyx not villous, only below with some slightly hairy stripes; lobes broad, membranous.
Rare in Qatar; recorded by Obeid (1975). Local name: *Lussa'k*.

2. *PARIETARIA* L.

Herbs with alternate, entire, exstipulate, not stinging leaves. Flowers polygamous, in sessile clusters in the leaf axils, each cluster including male, female and bisexual flowers intermingled and enclosed in an involucre of small bracts. In female and bisexual flowers perianth tubular or cup-shaped, 4-toothed, persistent enclosing the achene. In male flowers calyx of 4 sepals united at the base only, stamens 4.

1. *Parietaria alsinifolia* *Del.*, Fl. aegypt. Ill. 281, t. 50, f. 2 (1813); Post, Fl. Syr., Pal. et Sinai ed. 2, 2: 512 (1932); Rech., Fl. Lowland Iraq 170 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 57 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 195 (1978).

Annual soft herb. Stems filiform, diffuse or ascending, simple or branched from the base. Leaves small, on 0·5–1 cm long petioles; the blade ovate with rounded base, 3-nerved, entire. Flowers subsessile, in 3-flowered cymes in the leaf axils; the lower flower perfect, sterile, with a small lanceolate bract, the two others pistillate, with 3, cordate–ovate, membranous bracts, about 3 mm long. Perianth about 2 mm long.
Rare in Qatar; collected only from the large *rodah* in Al-Magda after heavy rainfall. The plant grows in the shade and is protected by the growth of *Ziziphus*.

3. *URTICA* L.

Annual herbs with opposite, serrate leaves, beset with stinging hairs. Flowers greenish, in ours monoecious, arranged in whorled racemes or spikes, or globose clusters. Perianth of 4 segments. Stamens 4. Fruit an oblong achene, compressed, enclosed in the enlarged, persistent perianth segments.

1. *Urtica urens* *L.* Sp. Plant ed. 1, 984 (1753); Rech., Fl. Lowland Iraq 169 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 55 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 195 (1978).

Erect annual herb, branching from the base. Lower leaves on petioles longer than the blade; the blade elliptic or oblong, acuminate at apex, acutely dentate at margin. Leaves stipulate. Staminate and pistillate flowers in spike- or raceme-like, simple inflorescence

in the leaf axils, on usually short peduncles, 0·5–1·5 cm long, but pistillate flowers predominating in most of the inflorescences.

Uncommon weed in Qatar. It grows in gardens and irrigated shady places.

3. *POLYGONACEAE A. JUSS.*

Herbs or woody plants, sometimes climbers, rarely trees. Stems usually jointed, with swollen nodes. Leaves mostly alternate; stipules ochreate. Inflorescences panicles, spikes or heads, composed of cymose clusters or sometimes of single flowers. Bracts 1–2, connate into a sheath (ochreole). Flowers bisexual, sometimes unisexual, actinomorphic. Perianth 2-whorled, sepaloid or coloured, usually persistent, often with wings or appendages. Stamens 6–9, opposite sepals. Ovary superior, 1-celled, of 3 carpels with 1 basal ovule. Fruit a flat or angular or winged achene, often enclosed within the membranous or leathery perianth.

A. Fruit or fruit-perianth lacking any sort of appendages. 2. *Polygonum*
B. Fruit-perianth developing wings, awns, spines or teeth.
 1. Fruit-perianth with rigid spines . . . . . 1. *Emex*
 2. Fruit-perianth toothed, awned or winged . . . 3. *Rumex*

1. *EMEX CAMPD.*

Annual, polygamous–monoecious herbs. Leaves alternate; ochreae membranous. Flowers clustered at nodes or arranged in axillary, leafless, interrupted racemes; flowers of lower whorls pistillate, upper ones hermaphrodite or staminate; a few flowers at base of stem pulled down by contratile roots and ripening under soil surface. Staminate flowers pedicellate, perianth herbaceous, 3–6-partite with equal spreading segments. Pistillate flowers sessile; perianth herbaceous, urceolate, 6-lobed. Stamens 4–6. Ovary trigonus, 1-ovuled; styles 3. Fruiting perianth ending in 3 recurved rigid spines.

1. *Emex spinosus* *(L.) Campd.*, Monogr. Rum. 58 (1819); Boiss., Fl. Orient. 4: 1005 (1879); Zohary, Fl. Palaest. 1: 67, t. 80 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 61 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 195 (1978).

Rumex spinosus L., Sp. Plant., ed. 1: 337 (1753). *R. glaber* Forssk., Fl. Aegypt.-Arab. 75 (1775).

Glabrous annual, 5–50 cm, many or few-stemmed. Roots more or less tuberous. Stems sometimes reddish. Leaves petiolate, ovate to oblong, entire, truncate to cordate at base, rounded and apiculate at apex. Staminate flowers 1·5–2 mm, on filiform pedicels together with some perfect ones, clustered at upper part of interrupted racemes. Pistillate flowers 1·5 mm, sessile or nearly so, clustered at nodes and lower parts of racemes; perianth urn-shaped, greenish-red, much growing in fruit, with outer segments spinescent, more or less recurved at apex and inner ones ovate–triangular, 3-ribbed. Achene about 4 mm, enclosed in perianth. Fruits of 2 kinds, aerial and subterranean, the latter crowded near root neck, larger and less spinescent than the former.

Common in Qatar on fine sandy soils; in depressions and along the margin of cultivated land. Local name: *Hinzab*. Flowering from March to April (Plate 18).

2. *POLYGONUM* L.

Annual or perennial herbs, sometimes woody below. The base of the petiole expanded into a membranous, tubular sheath (ochreate), and membranous, interfloral bracts (ochreoles). Flowers bisexual, reddish or greenish, in small cymes, often forming dense spike-like inflorescence. Perianth 4–5-cleft or parted, herbaceous or petaloid. Fruit-perianth small, not enlarging, without appendages.

1. ***Polygonum equisetiforme*** *Sibth. et Sm.* (1806); Täckh., Stud. Fl. Egypt, ed. 2, 64 (1974).

A perennial herb with woody root and procumbent branches. Leaves elliptic–lanceolate, acute, shorter than 2 cm. Upper leaves smaller than those below, floral ones hardly exceeding the flowers. Inflorescence of spike-like aspect.

This plant has been recorded by Obeid (1975); it has not been seen by the present author. Arabic name: *Qadab*.

3. *RUMEX* L.

Herbs; flower cymes whorled, forming raceme-like inflorescences. Flowers unisexual or bisexual. Perianth segments 6, greenish, outer 3 usually enlarging in fruit, either into scarious reticulate wings or into bristly toothed valves, enclosing the fruit.

1. Fruit-perianth toothed . . . . 2. *R. dentatus*
2. Fruit-perianth winged.
   a. Valves (inner 3 sepals) distinctly unequal, flat, more or less denticulate, with red marginal vein . . . . 1. *R. cyprius*
   b. Valves subequal, longitudenally folded, entire, without marginal vein . 3. *R. vesicarius*

1. ***Rumex cyprius*** *Murb.*, Lund. Univ. Arsskr. N.F. Afd. 2, 3, No. 14: 20 (1907) emend. Sam., Bot. Notis. 1939: 509 (1939); Rech. f., Candollea 12: 34 (1949); Zohary, Fl. Palaest. 1: 61, t. 69 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 67 (1974).
R. cyprius Murb. ssp. *disciformis* Sam., Bot. Notis. 1939, 512 (1939).

Annual, gabrescent; stems branching from base, rather thick below. Leaves fleshy, ovate–triangular, acute. Valves (inner tapels) distinctly unequal, membranous, flat, the larger one up to 2 cm long and broad, netted-veined with a vein around margin.

The plant is rare in Qatar; it grows in silty depressions. Flowering in the spring.

2. ***Rumex dentatus*** *L.*, Mant. Alt. 226 (1771); Boiss., Fl. Orient. 4: 1013 (1879); Rech. f., Candollea 12: 116 (1949); Zohary, Fl. Palaest. 1: 65, t. 77 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 65 (1974).

Annual, glabrous, erect. Lower leaves larger than upper ones. Petioles of lower leaves longer than those of upper leaves. Flower whorls upwards forming a leafy raceme. Perianth segments with a large grain in the centre and a few teeth on each side.

The plant is rare in Qatar, it grows on sandy soil along the borders of cultivated land; mainly in shady moist places. Flowering from March to May.

3. ***Rumex vesicarius*** *L.*, Sp. Plant., ed. 1, 336 (1753); Boiss., Fl. Orient. 4: 1017 (1879); Rech. f., Candollea 12: 35 (1949); Zohary, Fl. Palaest. 1: 61, t. 68 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 67 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 195 (1978).

Annual, glabrous, with stems branching from the base. Leaves fleshy, petiolate, ovate to deltoid, obtuse. Valves 1–2 cm, longer than pedicels, membranous, subequal, purplish and netted-veined, without marginal vein (Plate 18).

The plant is fairly common in Qatar. Leaves are eaten green and cooked; also used in medicine as a laxative, tonic, etc.

4. *MOLLUGINACEAE WIGHT*

Annual (our species) or perennial herbs. Leaves simple, opposite or in whorls, not fleshy. Sepals 5; petals 0, sometimes replaced by petaloid staminoides. Stamens 3–5 (our genus). Ovary superior, placentation axile. Fruit a capsule opening by 3–5 valves.

1. *MOLLUGO L.*

Annual, glabrous, erect or procumbent herbs. Flowers very small, white, in capillary, corymbose or umbel-like, straggling cymes. Sepals 5, free, obtuse, glabrous, broadly scarious-margined. Petals absent. Fruit a capsule.

1. ***Mollugo cerviana*** *(L.) Ser.* in DC., Prodr. 1: 392 (1824); Cullin in Davis, Fl. Turkey 2: 346 (1967); Täckh., Stud. Fl. Egypt, ed. 2, 72 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 212 (1978).

Pharnaceum cerviana L., Sp. Plant., ed. 1, 272 (1753). *P. umbellatum* Forssk., Fl. Aegypt.-Arab. 58 (1775).

Mollugo umbellata (Forssk.) Ser. in DC., Prodr. 1: 393 (1824).

Delicate, erect annual herb, 5–15 cm high, with many filiform, terete subspreading stems. Leaves sessile, basal rosetted, in whorls of up to 10. Inflorescence lax, terminal or axillary, umbellate cymes. Flowers green; perianth segments greenish with scarious margins, obtuse, 2–3 mm, persistent around the ripe capsule.

Rare in Qatar.

5. *AIZOACEAE J. G. AGARDH*

Annual or perennial, commonly succulent, herbs (our species) or rarely low shrubs. Flowers hermaphrodite, solitary or crowded, actinomorphic. Perianth simple, sometimes double with sepals and petals (petaloid staminodes). Calyx often fleshy, sepals 3–5. Petals small or wanting, or replaced by petaloid staminodes in 1–2 series. Stamens 5 to many, inserted on calyx tube and alternating with sepals. Fruit usually a loculicidal or circumcissile capsule, occasionally indehiscent and berry-like.

+	Calyx tube (or hypanthium) adnate to ovary; petal-like staminodes numerous	2. *Mesembryanthemum*
+ +	Calyx tube (or hypanthium) free from ovary, petal-like staminodes absent	1. *Aizoon*

1. *AIZOON* L.

Fleshy herbs and undershrubs; leaves exstipulate, usually alternate, succulent. Flowers axillary, solitary or in leafy cymes; hypanthium free from the ovary except towards base. Calyx lobes 4–5, often white or coloured within. Petals and petaloid staminodes wanting. Stamens *ca.* 15–20, inserted in fascicles near the base of the hypanthium, between the calyx lobes. Ovary 4–5-locular; with 2 to many ovules in each loculus; styles free, 4–5. Fruit a loculicidial capsule; value often keeled. Seeds numerous, reniform.

1. *Aizoon canariense* L., Sp. Plant, ed. 1, 488 (1753); Boiss., Fl. Orient. 2: 765 (1872); Zohary, Fl. Palaest. 1: 75 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 73 (1974); Ghafoor, Fl. Lib. 26: 4 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 213 (1978).
Glinus crystallinus Forssk., Fl. Aegypt.-Arab. 95 (1775).

Annual or perennial prostrate herb growing close to the ground with thick, almost woody zigzag-curved branches with alternate branchlets. Leaves alternate, with up to 15 mm long petiole, fleshy, spathulate to oblong–obovate, cuneate and tapering at base, obtuse at apex. Flowers 4–8 mm, sessile, solitary in leaf axils or dichotomies of the stem, stellate. Perianth segments 2–5 mm, broadly ovate to short-triangular, greenish outside, yellow within. Stamens usually 15 in 5 branches of 3 each, inserted on rim of calyx tube. Ovary pentagonal. Capsule woody, somewhat flattened. Seeds blackish-brown, 1 mm long, reniform.

Very common in Qatar on compact shallow alluvial soils in shallow depressions and along roadsides, and in depressions after drying of runoff water. Flowering from February to May. Local name: *Gafnah* and *Chafna.* Leaves eaten as salad (Plate 19).

MESEMBRYANTHEMUM L.

Annual or biennial, succulent herbs, with stems more or less dichasially branched. Stems and leaves covered with glistening papillae. Leaves exstipulate, at first opposite, later alternate, flat or terete, sessile but basal short petioled. Flowers mostly axillary, solitary or in cymes, white, yellow, pink or red. Calyx with 4–5 unequal segments. Petaloid staminodes many, linear, united at the base and forming a short tube. Stamens numerous. Ovary semi-inferior; placentation axile. Capsule 5-locular, subglobular–pentagonous, depressed at apex, ligneous or fleshy leathery, opening by a star-shaped slit. Seeds many, minute.

1. Flowers sessile or nearly so, petaloid staminodes shorter than calyx. Leaves less than 5 mm broad, the upper alternate, the lower opposite . . . . 2. *M. nodiflorum*
2. Flowers short-pedicelled. Petaloid staminodes longer than calyx. Leaves 0·8–1·5 cm thick, all opposite . . . . 1. *M. forskählei*

1. *Mesembryanthemum forskählei* *Hochst* in Schimp., Pl. Arab. Exs., ed. 2 (1832); Täckh., Stud. Fl. Egypt, ed. 2: 73 (1974); Ghafoor, Fl. Lib. 6: 16 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 212 (1978).

Opophytum forskählii (Hochst. ex Boiss.) N.E. Br., Gard. Chron. ser. 3, 84: 253 (1928).

Annual, dichotomously branched, papillose, erect herb. Leaves up to 5 × 0·8–1·5 cm, subterete to terete, fleshy, tapering from a broader clasping base; apex obtuse. Flowers solitary, in dichotomies of stem and terminal. Calyx with subequal 5 conical lobes. Staminodes white, longer than calyx. Ovary semi-inferior, much swollen, 5-angled. Capsule club-shaped.

Sandy soils, rare in Qatar, recorded by Boulos (1978). Flowering from March to May. Local name: *Samh*. It has been reported that bread is made from the seeds; the latter are released by immersing the fruits in water so that their valves open hygroscopically.

2. *Mesembryanthemum nodiflorum* *L.*, Sp. Plant., ed. 1, 480 (1753); Boiss., Fl. Orient. 2: 764 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 486 (1932); Rech. f., in Arkiv. för Bot., ser. 2, 1: 468 (1950); Zohary, Fl. Palaest. 1: 76, t. 93 (1966); Davis, Fl. Turkey 2: 345 (1967); Täckh., Stud. Fl. Egypt, ed. 2, 73 (1974); Ghafoor, Fl. Lib. 26: 15 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 212 (1978).

Cryophytum nodiflorum (L.) L. Bol., S. Afr. Gard., 17: 327 (1927).

Annual, minutely papillose, fleshy herb. Stems cylindrical, spreading. Lower leaves opposite, sessile, subterete, linear; apex blunt; margins entire; upper leaves alternate. Inflorescence much branched; flowers solitary in the axils of foliaceous bracts or reduced leaves, or terminal, sessile or subsessile; hypanthium cup-shaped about 5 mm long. Sepals 5, unequal. Petaloid staminodes numerous in several series; white, linear to filiform, shorter than calyx. Stamens 15. Ovary 5-angled; stigmas 5, sessile. Fruit a pentagonal, flattened capsule, about 10 mm wide. Seeds reniform.

Common in Qatar in dry salines; irrigated slightly saline fields, waste ground bordering cultivated land. Flowering from April to May.

6. *PORTULACACEAE A. JUSS.*

Herbs or undershrubs; stems and leaves often succulent. Flowers regular, solitary or in cymes, bisexual, sepals usually 2, petals (2–) 4–6, occasionally more. Stamens as many as petals, opposite to them. Ovary 1-loculed; ovules on a central basal placenta. Fruit a capsule.

PORTULICA L.

Glabrous fleshy herbs. Leaves opposite or alternate, often forming an involucre-like cluster below the flowers. Flowers solitary or in cymes. Sepals 2, the lower overlapping the upper. Petals 4–5; stamens 5 or more. Fruit a capsule opening by a lid; seeds tubercled.

1. *Portulaca oleracea* *L.*, Sp. Plant., ed. 1, 445 (1753); Boiss., Fl. Orient. 1: 757 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 220 (1932); Zohary, Fl. Palaest. 1: 78 (1966); Davis, Fl. Turkey 2: 13 (1967); Täckh., Stud. Fl. Egypt, ed. 2: 76 (1974); Meikle, Fl. Cyprus 1: 287 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 220 (1978).

Annual, glabrous, much branching succulent herb. Leaves alternate, sessile or very shortly petiolate, obovate or spathulate, 0·5–5 cm long, 0·3–2 cm wide, apex rounded (or occasionally emarginate), margins entire; stipules reduced to a very small cluster of bristles. Flowers small, yellow, sessile in clusters on the forks and tips of the branches, opening in the morning only. Capsule ovoid–conical, about 7–8 mm long and 5–6 mm wide, many seeded, opening by a lid. Seeds 0·5–1 mm across, black, tuberculate.

It is a common weed in the gardens and cultivated land in Qatar. Also, commonly cultivated as a vegetable. Flowering mainly from February to September. Local name: *Barbir*. Abu Hanifa Ad-Dinuary stated that the name *Barbin* is used for such plants; this is a Persian name which may be modified to *Barbir* in the Arab Gulf states. In other countries it has the name *Rigla* (Plate 20).

7. *CARYOPHYLLACEAE A. JUSS*

Herbs or shrublets. Leaves opposite, decussate, simple, entire, with or without stipules. Inflorescence cymose. Flowers regular, bisexual. Perianth usually double. Calyx of 5 sepals, connate or free, sometimes subtended by bracts. Corolla of 5 petals. Stamens as many as petals or twice. Fruit a many seeded tooth-capsule or a nut. Placentation basal or free central.

A. Calyx tubular, cleft till a little above the base.
  I. Calyx with 5 green wings (mainly in fruit) . . . . 11. *Vaccaria*
  II. Calyx 10-nerved, wingless . . . . 7. *Silene*
B. Calyx of free sepals.
  I. Fruit a capsule.
    1. Leaves stipulate.
      a. Leaves subulate.
        x. Leaves opposite . . . . 9. *Spergularia*
        xx. Leaves whorled (appearing so) . . . . 8. *Spergula*
      b. Leaves flat or revolute-margined.
        x. Glabrous plants, flowers pedicelled.
          o. Bracts and stipules altogether scarious. . . . . . 4. *Polycarpon*
          oo. Bracts and stipules with green herbaceous middle . 5. *Robbairea*
        xx. Hairy plants, if glabrous flowers sessile. . . . . . 3. *Polycarpaea*
    2. Leaves exstipulate, flat . . . . 10. *Stellaria*
  II. Fruit indehiscent.
    1. Inflorescence spiny but not scarious . . . . 6. *Sclerocephalus*
    2. Inflorescence silvery-looking of scarious bracts . . . . . 2. *Paronychia*
    3. Inflorescence neither spiny, nor scarious. Small mat-shaped plants . . . . 1. *Herniaria*

HERNIARIA L.

Annual or perennial herbs, with prostrate stems. Flowers small, green, in axillary or leaf-opposed clusters. Sepals and petals 4–5, the latter filiform. Stamens 2–5. Fruit a subspherical utricle.

1. Calyx 4-merous. Perennials . . 1. *H. hemistemon*
2. Calyx 5-merous. Annuals . . . 2. *H. hirsuta*

1. *Herniaria hemistemon* *J. Gay* in Duchartre, Rev. Bot. 2: 371 (1847); Boiss., Fl. Orient. 1: 742 (1867); Rech. f., Fl. Lowland Iraq 224 (1964); Zohary, Fl. Palaest. 1: 134, t. 192 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 99 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 222 (1978).

Perennial, herbaceous from a woody base, puberulent or glabrescent. Leaves short-petioled, oblong–elliptical, obtuse, the lower ones opposite. Flowers sessile or nearly so, in axillary clusters. Sepals with curved hairs. Stamens 2. Utricle membranous, included in calyx tube.

A common plant on compact and gravelly soils. Widespread in Qatar. Flowering from February to May (Plate 20).

2. *Herniaria hirsuta* *L.*, Sp. Plant, ed. 1, 218 (1753); Rech. f., Fl. Lowland Iraq 224 (1964); Zohary, Fl. Palaest. 1: 133–134, t. 191 (1966); Täckh., Stud. Fl. Egypt, ed. 2: 99 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 222 (1978).

H. cinerea DC. in fam. et DC., Fl. Fr., ed. 3, 5: 375 (1815).

Hirsute–hispid annual, 4–15 cm. Branched from the base in one plane with branches almost at right angles to the main stem. Leaves 0·5–1 cm, the lower opposite, the upper alternate, acute, hairy on both surfaces. Stipules and bracts scarious. Flowers sessile in axillary head-like clusters. Calyx lobes 1–2 mm, oblong covered with bristly hairs shorter or longer than width of sepals, hooked or straight.

The plant is rare in Qatar. Flowering from February to April. It has been reported that this plant is used medicinally as diuretic, astringent, etc.

PARONYCHIA MILLER

Small, prostrate plants with entirely silvery scarious bracts and stipules. Leaves mostly flat. Flowers in heads, often entirely hidden in scarious bracts. Calyx 5-parted, petals filiform; stamens 3–5; style bifid.

1. *Paronychia arabica* *(L.) DC.* in Lam., Encycl. 5: 24 (1804); Boiss., Fl. Orient. 1: 746 (1867); Zohary, Fl. Palaest. 1: 132, t. 187 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 100 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 222 (1978).

Illecebrum arabicum L., Mant. Plant. 51 (1767).

A densely branched, mat-shaped annual, with glabrous (or slightly ciliated). Branches from summit to base with small, scarious flower-clusters, about 5 mm broad. Bracts slightly longer than flowers. Calyx lobes awned near apex, with hooked hairs at base.

The plant is common on sandy soils, particularly in central and southern Qatar (Plate 21).

POLYCARPAEA LAM.

Annual or perennial herbs. Leaves opposite or whorled, flat or revolute-margined; stipules scarious. Flowers many, in paniculate or corymbose cymes. Sepals 5, free, scarious-margined. Petals 5, shorter than calyx. Stamens 5. Ovary 1-loculed.

1. Hairy perennial . . . . . 1. *P. repens*
2. Glabrous annual . . . . . 2. *P. spicata*

1. *Polycarpaea repens* *(Forssk.) Aschers. et Schwenf.*, f. Oesterr. Bot. Zeitschr. 39: 126 (1889); Burtt et Lewis, Kew Bull. 7: 338 (1952–53); Rech., Fl. Lowland Iraq 224 (1964); Zohary, Fl. Palaest. 1: 127, t. 179 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 96 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 224 (1978).

Corrigiola repens Forssk., Fl. Aegypt.-Arab. 207 (1775).

Paronychia fragilis Del., Fl. Aegypt. Ill. 241, t. 24, f. 1 (1813); Boiss., Fl. Orient. 1: 737 (1867).

Prostrate, greyish-tomentose perennial. Leaves opposite or whorled, somewhat rigid, linear or lanceolate, revolute-margined; stipules scarious, silvery. Flowers minute, many, in dense cymes, short-pedicelled; bracts scarious. Sepals 5; petals 5, shorter than sepals. Capsule 3-valved.

The plant is common on sandy soil, usually on wind-blown sand; more common in southern Qatar. Flowering from March to May.

2. *Polycarpaea spicata* *Wight ex Arn.* Ann. Sc. Nat. Hist. 3: 51 (1839); Boiss., Fl. Orient. 1: 738 (1867); Täckh., Stud. Fl. Egypt, ed. 2, 96 (1974).

Small erect herb with forked, capillary, often dark-red stem and spathulate leaves, partly rosetted at the base, partly whorled at the branching points of the stem. Flowers sessile in a short, branched, terminal spike. Sepals glossy, pinkish-white, acute.

The plant is rare in Qatar. It has been recorded only in a waste land at Doha. Flowering from March to May (Plate 21).

POLYCARPON L.

Annual or perennial herbs. Leaves opposite or in whorls of 4; stipules scarious. Cymes dichasial, many flowered. Flowers small; sepals 5, free, keeled, scarious-margined. Ovary 1-loculed, 3-fid. Capsule 3-valved.

1. *Polycarpon tetraphyllum* *(L.) L.*, Syst. Nat., ed. 10, 2: 881 (1759); Boiss., Fl. Orient. 1:

735 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 209 (1932); Zohary, Fl. Palaest. 1: 126, t. 177 (1966); Davis, Fl. Turkey 2: 96 (1967); Täckh., Stud. Fl. Egypt., ed. 2: 97 (1974); Meikle, Fl. Cyprus 1: 277–278 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 224 (1978).
Mollugo tetraphylla L., Sp. Plant., ed. 1, 89 (1753).

Erect or procumbent annual, 3–10 cm. Leaves spathulate, in opposite or in false whorls of 4 or 6. Inflorescene lax cymes; pedicels as long as or longer than calyx. Sepals 2 mm. Petals half as long as sepals, white. Stamens 3. Capsule 1·5–2 mm long.

The plant is rare in Qatar. Flowering from February to April. It grows as a weed in gardens.

ROBBAIREA BOISS.

Glabrous prostrate herbs. Leaves opposite, stipulate. Inflorescence loose. Sepals 5; petals 5, clawed with ovate or obcordate limb, about as long as obtuse sepals. The scarious bracts and stipules always with green, herbaceous, hairy centre. Stamens 5, connate below. Ovary 1-loculed. Capsule 3-valved.

1. *Robbairea delileana* *Milne-Redhead*, Kew Bull. 1948: 452 (1949); Zohary, Fl. Palaest. 1: 128, t. 180 (1966); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 69 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 97 (1974); Migahid, Fl. Saudi Arab., ed. 2: 224 (1978).
R. prostrata (Forssk.) Boiss., Fl. Orient. 1: 735 (1867).

Often mat-shaped glabrous, perennial herb, dichotomously branched. Leaves small, oblong or linear, the lower ones spathulate. Racemes loose, many flowered. Pedicels usually as long as or longer than calyx. Calyx 2–3 mm. Petals about as long as calyx, whitish-pink. Capsule more or less included.

The plant is common in Qatar, particularly in the south in sandy habitats. Flowering from February to April (Plate 22).

SCLEROCEPHALUS BOISS.

Annual herbs; stems rigid; leaves fleshy, opposite, terete–linear; stipules scarious. Flowers 4–7, in short-peduncled, spiny heads. Calyx cup-shaped at base, adnate to bracts. Petals lacking. Stamens 2–5, styles bifid.

1. *Sclerocephalus arabicus* *Boiss.*, Diagn. Ser. 1, 3: 12 (1843) et Fl. Orient. 1: 748 (1867); Rech. f., Fl. Lowland Iraq 225 (1964); Zohary, Fl. Palaest. 1: 135, t. 193 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 101 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 222 (1978).
Paronychia sclerocephala Decne., Ann. Sc. Nat. Bot. Ser. 2, 5: 262 (1836).

Annual, glabrous, 3–15 cm. Leaves terete–linear, short-mucronate. Heads 0·5–1 cm, 3–7-flowered. Floral leaves united with flowers, spiny in fruit. Fruiting heads about 1 cm, spiny.

A very common plant on alluvial soils; in depressions and *rodat*. Flowering from February to April (Plate 22).

SILENE L.

Annual, biennial or perennial herbs or undershrubs. Leaves opposite, entire, exstipulate. Calyx tubular, mostly 10-nerved (in our species). Petals 5; stamens 10, adnate to the petals. Capsule borne on a carpophore, rarely sessile.

1. Leaves linear, very narrow, petals with deep linear lobes . . 1. *S. arabica*
2. Leaves obtuse, petals with obovate obtuse lobes . . . . 2. *S. villosa*

1. *Silene arabica* *Boiss.*, Fl. Orient. 1: 593 (1867); Burtt et Lewis, Kew Bull. 7: 342–343 (1952–53); Täckh., Stud. Fl. Egypt, ed. 2, 86 (1970); Migahid, Fl. Saudi Arab., ed. 2, 1: 226 (1978).

S. affinis Boiss., Diagn. Ser. 2, 1: 72 (1856); Rohrbach, Monogr. Gatt. Silene 104 (1863); non *S. affinis* Godr., Fl. Jav., ed. 1, 60 (1854).

Herb of variable size, from a few up to 30 cm, glandular-viscid. Leaves narrow-linear. Flowers long-pedicelled. Carpophore at least one-third of the capsule or more. Petals with deep, linear lobes, white. Seeds with ear-shaped depressions laterally and an obtuse groove dorsally.

Rare in Qatar, on sandy soil. The plant is eaten by sheep, goats and camels. Flowering in March.

2. *Silene villosa* *Forssk.*, Fl. Aegypt.-Arab. 88 (1775); Boiss., Fl. Orient. 1: 592 (1867); Rohrbach, Monogr. Gatt. Silene 110 (1868); Burtt et Lewis, Kew Bull. 7: 346–347 (1952–53); Täckh., Stud. Fl. Egypt, ed. 2, 86 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 226 (1978).

S. canopica Spreng. Syst. Veg. 2: 40 (1825).

Procumbent annual herb, glandular-pilose; leaves obtuse. Calyx 15–25 mm long with obtuse teeth. Petals long than calyx, rose-coloured, divided about one-half of its half length into 2 obovate obtuse lobes. Fruit pedicels patent or reflexed. Carpophore at least one-third the capsule or more.

Rare in Qatar, on sandy soils. Flowering from March to April (Plate 23).

SPERGULA L.

Annual herbs with filiform spuriously whorled leaves; stipules small, scarious. Cymes terminal, dichasial, loose. Sepals 5, free, herbaceous and often somewhat fleshy, scarious at margins. Petals 5, white. Stamens 10. Ovary 1-celled; styles 5. Capsule 5-valved.

1. *Spergula fallax* *(Lowe) Krause* in Sturm Deutschl. Fl., ed. 2, 5: 19 (1901); Rech. f., Fl. Lowland Iraq 229 (1964); Zohary, Fl. Palaest. 1: 122, t. 170 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 95 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 223 (1978).

Spergularia fallax Lowe in Hook., Kew Journ. 8: 289 (1856). *Spergula flaccida* (Roxb.) Aschers., Verh. Bot. Ver. Prov. Brandenb. 30: 311 (1889). *Arenaria flaccida* Roxb., Hort. Bengal. 34 (1814) non Glaiv. (1811). *Spergularia pentandra* L. var. *intermedia* Boiss., Diagn. Ser. 2, 1: 93 (1853) et Fl. Orient. 1: 73 (1867).

Glabrous annual herb, 10–25 cm. Leaves capillary, obtuse, not grooved beneath.

Panicle branched. Pedicels filiform, generally longer than calyx. Sepals 3–4 mm, white-margined. Petals shorter than sepals, white. Stamens 10. Capsule 4–5 mm, ovoid or subglobular, 3-valved. Seeds lenticular, with hyaline wing almost as broad as seed.

It is very common in Qatar. The plant grows densely in the shade of *Ziziphus* and *Acacia* trees on the alluvial soil. Flowering from February to May (Plate 23).

SPERGULARIA (PERS.) J. & C. PRESL.

Annual or perennial herbs, glabrous or glandular, decumbent or ascending. Leaves opposite, filiform; stipules scarious. Inflorescence cymose. Flowers 5-merous. Sepals free, with scarious margins. Petals white or pink. Stamens 10. Ovary 1-loculed, many ovuled, styles 3. Fruiting pedicels reflexed. Capsule 3-valved.

A. Fruit-pedicel mostly as long as the capsule . . 1. *S. bocconii*
B. Fruit-pedicel much longer than capsule . . . 2. *S. diandra*

1. ***Spergularia bocconii*** *(Sol. ex Scheele) Aschers. et Graebn.*, Syn. Mitt. Europ. Fl. 5, 1: 849 (1919); Zohary, Fl. Palaest. 1: 125, t. 175 (1966); Davis, Fl. Turkey 2: 95 (1967); Täckh., Stud. Fl. Egypt, ed. 2: 95 (1974); Meikle, Fl. Cyprus 1: 275 (1977).

Arenaria bocconi Sol., Pl. Cors. (1825) *nom nud. Alsine bocconii* Scheele, Flora 26: 431 (1843). *Spergularia atheniensis* Aschers. in Schweinf., Beitr. Fl. Aeth. 267, 305 (1867).

Annual or biennial, 5–25 cm high, often tinged purplish. Leaves 1–3 × 0·1 cm; floral leaves shorter; stipules triangular, white. Inflorescence many flowered, resembling one-sided racemes. Pedicles as long as or shorter than sepals. Sepals 2–3·5 mm. Petals shorter than sepals, pink. Capsule not exceeding calyx. Seeds wingless, greyish-brown.

Common in Qatar. It grows in depressions on alluvial soil, especially localities protected by the growth of *Ziziphus* trees. Flowering from March to May.

2. ***Spergularia diandra*** *(Guss.) Heldr. et Sart.*, Herb. Graec. Norm. No. 492 (1855); Boiss., Fl. Orient., 1: 733 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 207 (1932); Zohary, Fl. Palaest. 1: 124, t. 173 (1966); Davis, Fl. Turkey 2: 95 (1967); Täckh., Stud. Fl. Egypt, ed. 2, 95 (1974); Meikle, Fl. Cyprus 1: 275 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 223 (1978).

Arenaria diandra Guss., Prodr. Fl. Sic., 1: 515 (1827).

Annual slender herb with very thin leaves. Inflorescence usually leafless, many flowered, dichasially branched. Pedicels longer than flowers. Sepals 2–3 mm, about as long as or longer than calyx. Seeds wingless.

The plant grows as a weed in gardens and fields. It is not as common as *Spergularia bocconii* in Qatar. Flowering from March to April.

STELLARIA L.

Mostly annual herbs. Leaves flat, sometimes petiolate. Flowers in dichasial cymes. Sepals 5 free, petals 5, white deeply bifid down to the base, or absent. Ovary 1-locular; styles 3. Capsule globose, 6-valved, not exceeding the calyx.

1. ***Stellaria media*** *(L.) Vill.*, Hist. Plant. Dauph. 3: 615 (1789); Boiss., Fl. Orient. 1: 707 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 201 (1932); Zohary, Fl. Palaest. 1: 117, t. 162

(1966); Davis, Fl. Turkey 2: 69 (1967); Täckh., Stud. Fl. Egypt, ed. 2, 92 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 224 (1978).
Alsine media L., Sp. Plant., ed. 1, 272 (1753).

A soft, green, richly branched, sprawling annual. Stems with a single line of hairs. Leaves ovate, with a flattened petiole almost as long as the lamina; upper leaves shortly petiolate to sessile. Inflorescence sometimes leafy. Petals as long as sepals, or wanting, deeply 2-lobed. Stamens 1–10. Capsule ovoid, rather longer than the calyx, 6-valved.
A rare weed in gardens. Flowering from January to May.

VACCARIA MEDICUS

Erect annual herbs with dichotomously branched stem. Leaves ovate or lanceolate, sessile. Inflorescence loose, dichotomously corymbose. Calyx inflated below with 5 conspicuous green wings. Petals 5; stamens 10. Capsule opening by 4 valves.

1. *Vaccaria pyramidata* *Medicus*, Phil. Bot. 1: 96 (1789); Rech. f., Fl. Lowland Iraq 246 (1964); Zohary, Fl. Palaest. 1: 104, t. 140 (1966); Täckh., Stud., Fl. Egypt, ed. 2, 82, t. 16 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 225 (1978).
Saponaria vaccaria L., Sp. Plant., ed. 1, 409 (1753); Boiss., Fl. Orient. 1: 525 (1867). *Vaccaria segetalis* (Neck), Garcke in Aschers., Fl. Brandenb. 1: 84 (1800); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 162 (1932).

Erect annual herb. Stems glabrous, often distinctly swollen at nodes. Leaves lanceolate, with sessile cordate base. Inflorescence lax, much-branched. Flowers long-pedicelled (2–5 cm); often rose-coloured. Calyx with 5 conspicuous darker green wings, calyx-teeth triangular, 1–2 mm long, broadly membranous-margined. Petals longer than sepals. Stamens 10. Capsule broadly ovoid or almost globose, 7–10 mm long, 6–7 mm wide.
It is rare in Qatar, and grows as a weed in cultivated and fallow fields. Flowering in the spring.

8. *CHENOPODIACEAE VENT.*

Annual or perennial herbs or shrubs, often more or less succulent. Leaves usually alternate, sometimes opposite, simple, often fleshy and terete or reduced to scales, exstipulate. Flowers small, greenish. Perianth simple, sepaloid, persistent, of 5 segments or less. Stamens 5 or less, opposite perianth lobes. Ovary 2-carpelled, 1-loculed, with one basal ovule. Fruit an utricle or achene, free or adherent to perianth. Fruiting perianth sometimes winged or appendiculate.

1. Leaves flat, broad.
   A. Shrubs . . . . 3. *Atriplex*
   B. Herbs.
      a. Fruit hidden in white fleece . . . . 4. *Bassia eriophora*
      b. Fruit surrounded by narrow, almost free perianth segments, connate at base only.
         o. Flowers in groups of 2–4, connate at their perianth bases, sessile . . . . 5. *Beta*
         oo. Flowers numerous, in crowded head-like clusters, these spiked or racemed . . . . 6. *Chenopodium*

2. Leaves terete or otherwise shaped (if flat very narrow).
   A. Stem jointed with opposite leaves . . . . 1. *Anabasis setifera*
   B. Stem not jointed, with alternate leaves.
      a. Spiny plants.
         o. Fruit-perianth a star of small radiating spines . . . 4. *Bassia muricata*
         oo. Leaves spiny tipped.
            x. Leaves clasping . . . . 7. *Cornulaca*
            xx. Leaves not clasping . . . . 9. *Halogeton*
      b. Spineless plants.
         o. Fruit-perianth winged.
            + 5 wings of equal size, all spreading . . . . . 12. *Salsola*
            + + One wing spoon-shaped, covering the fruit, others spreading. Leaves cylindrical thickening towards apex. Stems white shining . . . . 14. *Seidlitzia*
         oo. Fruit-perianth wingless.
            + Ovary included in the urn-shaped perianth and adnate to it. Very sappy plants . . . . . . 13. *Schanginia*
            + + Ovary free from the perianth . . . . 15. *Suaeda*
3. Leaves rudimentary.
   A. Leaf rudiments forming small, densely decussate, bud-like knots along the stem . . . . 8. *Halocnemum*
   B. Leaf rudiments succulent, perfoliate, rendering the stem of a jointed aspect . . . . 10. *Halopeplis*
4. Leaves absent, shrubs or succulents with jointed stem.
   A. Fruit-perianth winged; woody plants . . . . 11. *Hammada*
   B. Fruit-perianth wingless; succulents . . . . 2. *Arthrocnemum*

1. *ANABASIS L.*

Shrub with jointed thick fleshy shoots. Leaves opposite or reduced to scales. Flowers solitary or clustered, perfect, with 5 perianth segments and 5 free stamens. Fruit-perianth winged.

1. *Anabasis setifera* *Moq.*, Chenopod. Monogr. Enum. 164 (1840); DC., Prodr. 13, 2: 214 (1849); Burtt et Lewis, Kew Bull. 1954, 3: 378 (1954); Zohary, Fl. Palaest. 1: 178 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 128 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 273 (1978).

Seidlitzia lanigera Post, Fl. Syr., Pal. et Sinai, ed. 1, 689 (1896).

Undershrub with numerous erect stems, 20–60 cm. Branches fleshy, 4-angled. Leaves opposite, 5–15 × 2–6 mm, fleshy cylindrical, furrowed above and ending in a soon deciduous thick capillary spine. Flowers 3–7 in a cluster, mainly in the upper axils. Fruit-perianth 4–6 mm, 5-winged; fruit wings 3–5 mm, unequal, pale-yellow. Seeds vertical.

A common plant in Qatar. It dominates a community abounding on wind-eroded coastal salines slightly elevated above sea level. The plant is eaten by camels. Flowering from August to November. Local name: *Sha'ran*; a name used in Kuwait and Bahrain for the same plant (Plate 24).

2. *ARTHROCNEMUM MOQ.–TAND*

Shrubs with jointed stems and branches. Leaves with rudimentary lamina. Flowers in terminal spicate inflorescences; in groups of 3 in a horizontal row, partially protruding from hollows in the joints of the spike. Wings absent.

1. ***Arthrocnemum glaucum*** *(Del.) Ung.–Sternb.* Atti Congr. Firenze 283 (1874); Aellen et Hillcoat in Rech., Fl. Lowland Iraq 192 (1964); Zohary, Fl. Palaest. 1: (1966); Täckh., Stud. Fl. Egypt, ed. 2, 119 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 273 (1978).

Densely branched, robust plant with decumbent rooting base. Stems and branches erect or procumbent, succulent. Leaves opposite, connate, with rudimentary lamina. Flowers 3 in a cluster, in thick, cylindrical, obtuse spikes, with entire bracts, covering the flowers, which are at length partly but not wholly exerted.

A halophytic plant, common in the littoral salt marshes of Qatar. It dominates a community which abounds in the marshes near Al-Khor and Ras Ushirij. *Cistanche phelypaca* is usually parasatizing on *Arthrocnemum*. Flowering is mainly in the autumn (Plate 24).

3. *ATRIPLEX L.*

Perennial or annual herbs or shrubs. Leaves flat, alternate or rarely opposite and frequently mealy or closely tomentose. Flowers unisexual (plants monoecious or dioecious), in terminal or axillary clusters. Male flowers with 5-parted perianth and 5 stamens. Female flowers with the ovary included between 2 flat, leaf-like bracts; united at base and later growing in size enclosing the fruit.

1. ***Atriplex leucoclada*** *Boiss.*, Diagn. Ser. 1, 12: 95 (1853) et Fl. Orient. 4: 915 (1879); Aellen, Bot. Jarb. 70: 21 (1939); Eig, Pal. J. Bot. Jer. Ser. 3: 123 (1945); Burtt et Lewis, Kew Bull. 1954, 3: 379 (1954); Zohary, Fl. Palaest. 1: 146 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 111 (1978); Migahid, Fl. Saudi Arab., ed. 2, 1: 247 (1978).

Shrub, to 50 cm, silvery or not, with whitish branches. Leaves thin, triangular-deltoid, dentate-lobed, short petioled. Flowers in terminal axillary inflorescences; the terminal of mixed male and female flower clusters, spike-like or paniculate; the axillary of female flowers only. Fruit-perianth broadest above the middle, bell-shaped, herbaceous, smooth, 3-lobed with the central lobe longer than the lateral ones.

The plant is found in northern Qatar. It grows on hard, gravelly soils, usually protected by *Lycium shawii* shrubs; eaten by sheep and camels. Local name: *Ar rughal*, a name used in Kuwait also. Flowering from March to July (Plate 25).

4. *BASSIA ALL.*

Annual or perennial herbs. Stems not jointed. Leaves alternate, sessile, entire, flat or semiterete, usually linear, oblong to lanceolate. Flowers sessile, perfect or female by abortion, axillary and terminal, without bracteoles. Fruiting-perianth with prickles or tubercles.

1. Flowers hidden in thick white fleece; fruiting-perianth usually not spiny; leaves broad . . . . 1. *B. eriophora*
2. Flowers not hidden in fleece; fruiting-perianth with long, yellow, spreading, straight spines; leaves narrowly linear . . . . . . 2. *B. muricata*

1. *Bassia eriophora* *(Shrad.) Aschers.* in Schweinf., Beitr. Fl. Aethiop. 1: 187 (1867); Burtt et Lewis, Kew. Bull. 1954, 3: 380 (1954); Aellen et Hillcoat in Rech., Fl. Lowland Iraq 190 (1964); Zohary, Fl. Palaest. 1: 153, t. 220 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 118 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 252 (1978).

Kochia eriophora Schrad., Neues Journ. Bot. Schrad. 3: III, IV et 86, t. 3 (1809). *K. latifolia* Fresen., Mus. Senken. 1: 179 (1834); Boiss., Fl. Orient. 4: 927 (1879). *Bassia eriophora* var. *rosea* Eig, Pal. Journ. Bot. Jer. Ser. 3: 125 (1945).

A small annual herb. Leaves 6–20 × 2–3 mm, thinly hairy, somewhat fleecy. Flowers hidden in thick, white fleece and forming dense leafy spikes. Fruiting-perianth with short protuberances incurved at apex.

Rare in Qatar. It grows in waste places and stony habitats. Flowering from March to June.

2. *Bassia muricata* *(L.) Aschers.* in Schweinf., Beitr. Fl. Aethiop. 1: 187 (1867); Zohary, Fl. Palaest. 1: 152, t. 219 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 115 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 252 (1978).

Salsola muricata L., Mant. 54 (1767). *Kochia muricata* (L.) Schrad., Neues Journ. Bot. Schrad. 3: III, IV et 86 (1809); Boiss., Fl. Orient. 4: 926 (1879).

Annual, densely villose. Leaves 5–15 × 1–2 mm, linear, densely hairy. Flowers in clusters subtended by oblong bracts and forming loose, leafy spikes; each cluster consisting of 1 female flower and 1–2 bisexual flowers. Perianth of 5 segments, each with a 3–4 mm long spine, 2–3 times as long as fruit.

Rare in Qatar. Flowering from February to June.

5. *BETA* L.

Annual or perennial herbs with furrowed stems. Leaves broad, alternate. Flowers sessile, clustered, in leafy spikes, greenish. Perianth of 5 lobes thickening in fruit. Utricles enclosed in perianths that are united by their swollen bases to form a pseudocarp.

1. *Beta vulgaris* *L.*, Sp. Plant., ed. 1, 222 (1753); Boiss., Fl. Orient. 4: 898 (1879).

Annual or biennial herbs. Stems decumbent to erect, branched and leafy, sometimes coloured. Radical leaves oblong–ovate, obtuse, up to 10 cm long. Cauline leaves rhombic–oblong to lanceolate. Flowers in 2–4-flowered clusters, arranged in long, more or less interrupted spikes. Bracts longer or shorter than clusters, linear–lanceolate, abortive towards apex. Perianth lobes 2–5 mm often incurved.

Subsp. ***perennis*** *(L.) Aellen*, Ber. Schweiz. Bot. Ges. 48 (1938); Rech., Fl. Lowland Iraq 183 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 105 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 252 (1978).

Perianth segments about as long as the diameter of the fruit, rounded triangular, not or hardly keeled, with soft base.

The plant is occasional in cultivated *rodat*, northern Qatar. It is eaten green and cooked. Flowering from March to April.

6. *CHENOPODIUM* L.

Annual weeds with alternate, petioled, flat leaves. Flowers very small, bisexual, numerous, in crowded head-like clusters, these spiked or racemed. Fruit surrounded by narrow, almost free perianth segments, connate at the base only. Perianth unchanged in fruit.

1. Leaves entire . . . . 1. *C. album*
2. Leaves densely and sharply dentate 2. *C. murale*

1. *Chenopodium album* *L.*, Sp. Plant., ed. 1, 219 (1753); Boiss., Fl. Orient. 4: 901 (1879): Blatter, Journ. Ind. Bot. Soc. 11: 41 (1932); Zohary, Fl. Palaest. 1: 142, t. 200 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 107 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 252 (1978).

Annual, white mealy, 30–80 cm. Lower leaves usually deltoid–ovate with scattered obtuse teeth, the upper ones lanceolate, usually entire. Flower clusters densely crowded and arranged in paniculately branched, elongated inflorescence. Perianth 5-segmented, scarious margined, enclosing fruit.

A weed in irrigated localities and damp places in gardens and lawns. Flowering from June to November (Plate 25).

2. *Chenopodium murale* *L.*, Sp. Plant., ed. 1, 219 (1753); Boiss., Fl. Orient. 4: 904 (1879); Burtt et Lewis, Kew Bull. 1954, 3: 380 (1954); Zohary, Fl. Palaest. 1: 142, t. 202 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 107 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 252 (1978).

Annual green herb, 25–70 cm. Leaves petiolate, triangular with tapering base, unequally and acutely dentate. Flowers small, green, in small clusters arranged in rich cymose panicles. Perianth 5-segmented, green, enclosing the fruit.

A very common weed in Qatar, growing in cultivated and waste land. Spilling of sewage in the desert results in a very dense growth of *C. murale* (Plate 25).

7. *CORNULACA* DEL.

Shrubs or annual herbs with continuous stems. Leaves small, alternate, spiny, which become a cushion when the spines disappear, hence old branches densely knotty. Flowers solitary or clustered in axils, woolly, with 5 perianth segments, united below into a hard cup, either all membranous or 1–2 of them developing into long spines.

1. Annual herbs 1. *C. aucheri*
2. Spiny shrubs 2. *C. monacantha*

1. *Cornulaca aucheri* *Moq.* Chenopod. Monogr. Enum. 163 (1840); Rech., Fl. Lowland Iraq 211 (1964); Täckh., Stud. Fl. Saudi Arab., ed. 2, 1: 259, 264, 265 (1978).

Dwarf annual herb, about 6 cm high, much branched from the base, minutely scabrous. Leaves half-clasping at base, about 1 cm long, 0·5 mm wide, hyaline-margined,

cuspidate-spiny, sparsely setaceous in axils. Flowers 2–3-clustered in the upper axiles. One or two segments of the perianth tapering into a long, subulate spine.

The plant is rare in Qatar. It inhabits sandy soil. Flowering from April to May (Plate 26).

2. *Cornulaca monacantha* *Del.*, Fl. Aegypt. Ill. 234, t. 22 (1813); Rech., f., Fl. Lowland Iraq 210 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 128 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 258 (1978).

A much-branched shrub with elongate branches. Leaves clasping at base, 8–10 mm long, tapering into a rigid spine; axils woolly. Flowers 3–5-clustered in the axils, hidden by dense wool. 1 or 2 of the perianth segments tapering into a spine in fruit.

Common in southern Qatar, particularly on deep sandy soils. More common along the road to the United Arab Emirates. Local name: *Thallaj*. Flowering in the autumn (Plate 26).

8. *HALOCNEMUM M. BIEB.*

A halophytic shrub with woody, continuous branches. Leaves rudimentary, forming small densely decussate, bud-like knots along the stem. Flowers perfect; perianth with 3 unequal segments; stamen 1. Wings absent.

1. *Halocnemum strobiolaceum* *(Pall.) M. Bieb.*, Fl. Taur. Cauc. 3: 3 (1819); Burtt et Lewis, Kew Bull. 1954, 3: 381 (1954); Rech., Fl. Lowland Iraq 191 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 118 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 260 (1978).

Salicornia strobilacea Pall., Reise Russ. Reich. 1: 412 et 481, tab. B, fig. 1, 2 (1771); Ill. Pl. 9, tab. 4 (1803). *S. cruciata* Forssk., Fl. Aegypt.-Arab. 2 (1775).

Richly branched undershrub. Easily recognized by its numerous, small, decussate, green tubercles along the branches. Leaves minute, opposite, connate, with rudimentary lamina. Flowers 3 in a cluster, in oblong to cylindrical, lateral and terminal spikes, with opposite bracts.

The plant grows in the littoral salt marshes which are usually inundated by sea water. It dominates a community in the salt marshes near Al-Khor and Abu Samra. Flowering in the autumn.

9. *HALOGETON C. A. MEY.*

Shrublet with continuous stem. Leaves alternate, sessile, fleshy, semi-cylindrical to subglobular, mostly terminating in a stiff bristle. Flowers in clusters, in axils among dense wool. Fruit with 2–5 wings.

1. *Halogeton alopecuroides* *(Del.) Moq.-Tand*, Chenopod. Monogr. Enum. 161 (1840); Boiss., Fl. Orient. 4: 985 (1879); Zohary, Pal. Journ. Bot. 1, 3: 253 (1939); Allen et Hillcoat in Rech., Fl. Lowland Iraq 212 (1964); Zohary, Fl. Palaest. 1: 179, t. 263 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 130 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 259 (1978).

Salsola alopecuroides Del., Fl. aegypt. Ill. 56, t. 21 f. 1 (1813). *Agathophora alopecuroides* (Del.) Bunge, Mem. Acad. Sci. Pétersb. Ser. 7, 4, 11: 92 (1862); Burtt et Lewis, Kew Bull. 1954, 3: 377 (1954).

A glabrous, dwarf shrub, 20–40 cm, much branching from base with white branches. Leaves 5–15 mm, fleshy, globose to prismatic-cylindrical, at tip obtuse with a needle-like, easily deciduous small spine; axils woolly. Flowers arranged in globular clusters in leaf axils along upper part of branches. Fruiting-perianth about 3 mm, usually with 2–3 (rarely 5) wings.

It is rare in Qatar, observed only in one locality along the road from Doha to northern Qatar, near Umm Slal Mohammed. Few dwarf undershrubs grow in a rocky habitat along the road, with *Zygophyllum quatarense*, *Salsola* sp., and *Atriplex leucoclada*. Flowering from April to July.

The plant is grazed by camels. It has the name *Hamdh* which is common for many chenopods (Plate 26).

10. *HALOPEPLIS BUNGE*

Succulent annual herbs or undershrubs. Leaf-rudiments opposite below, alternate upwards, fleshy, half-clasping at base, giving the branches a nodular appearance or necklace shape and the impression of a jointed stem. Flowers in groups of 3, immersed in the stem, forming dense spikes. Perianth obconical, 3-toothed, wingless.

1. *Halopeplis perfoliata* *(Forssk.) Bunge ex Aschers.* in Schweinf., Beitr. Fl. Aethiop. 1: 289 (1867); Täckh., Stud. Fl. Egypt, ed. 2, 118 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 260 (1978).

A stout, juicy succulent. Leaf-rudiments almost globose, enclosing the stem, appearing as peculiar swollen joints, usually reddish-green.

The plant occurs only in the littoral salt marshes of south-west Qatar along Salwa Gulf. It dominates a community adjacent to the sea shore. The plant forms mounds around its growth formed of calcareous maritime sand (Plate 27).

11. *HAMMADA BUNGE*

Unarmed shrubs with jointed stem. Leaves scale-like or absent. Flowers solitary, opposite, usually perfect with the 5 filaments joined into cup. Staminodes glandular. Fruiting-perianth with 5 scarious wings. Seeds horizontal.

1. *Hammada elegans* *(Bunge) Botsch.*, in Novit. Syst. Pl. Vasc. 362 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 127 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 273 (1978).

A rather stout shrub with thick glaucous branches, drying yellow. Leaves rudimentary, with woolly axis.

The plant occurs mainly in south-west Qatar in the area between Kara'anah and Abu Samrah, where it dominates a community inhabiting sandy habitats exposed to wind erosion. The plant forms sizeable mounds. It has been also recorded along the road from Doha to northern Qatar. Local name: *Rimth*, a name used throughout Arabia for different species of *Hammada* and *Haloxylon*.

The plant is used as camel browse and fuel. It was formerly used as a detergent by the Bedouins. Flowering from September to November (Plate 29).

12. *SALSOLA* L.

Herbaceous or shrubby plants, with continuous branches. Leaves small, alternate or opposite, often fleshy. Flowers small, bisexual, axillary, sessile. Perianth 5-fid or -parted. Fruit-perianth winged of equal size and spreading.

I. Coastal annuals with semiterete leaves, 1–6 cm long, half-clasping . . . . 4. *S. soda*
II. Shrubs and undershrubs, leaves minute, 1–2 mm long.
  1. Branches white, glabrous, glossy, leaves fleshy, ending in a bristle . . . . 3. *S. schweinfurthii*
  2. Branches not so, leaves not ending in a bristle.
    a. Of disagreeable odour. . . . . 1. *S. baryosma*
    b. No disagreeable odour.
      x. Leaves short linear–subulate, acute, 1·5–2 mm long, half-clasping at base . . . . 5. *S. vermiculata*
      xx. Leaves orbicular, rounded or obtuse, 1–1·5 mm long, sessile . . . . 2. *S. cyclophylla*

1. *Salsola baryosma* *(Roem. et Schult.) Dandy* in Andrews, Flow. Plant. Anglo-Egypt. Sud. 1: 111 (1950); Burtt et Lewis, Kew Bull. 1954, 3: 384 (1954); Zohary, Fl. Palaest. 1: 174, t. 256 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 124 (1974);

Chenopodium baryosmon Roem. et Schult., Syst. Veg., ed. 15, 6: 269 (1820). *Salsola foetida* Del. ex Spreng., Syst. Veg., ed. 16, 1: 925 (1924) non Pall. ex Vest. in Roem. et Schult., Syst. Veg., ed. 15, 6: 238 (1820). *S. foetida* Del., Fl. aegypt. Ill., n. 310 (1813) *nomen nuden*; Boiss., Fl. Orient. 4: 961 (1879).

Caroxylon foetidum Moq. in DC., Prodr. 13, 2: 178 (1849).

Shrub or sometimes annual, yellow-green, 25–70 cm or more, with an odour of decaying fish especially when in flower. Shoots pink towards the tip. Leaves minute, alternate, fleshy, densely clustered, generally absent on flowering branches. Inflorescence spike-like. Fruiting-perianth 2–4 mm in diameter (including wings), with white wings.

Common in Qatar especially on fallow land; salines, ruderal and segetal sites. The plant has different names in Arabia: *Gaghraf*, a variety of *Hamdh, Kharit* and *Shnan*. Flowering from June to November (Plate 28).

2. *Salsola cyclophylla* *Baker*, Kew Bull. 340 (1894); Rech., Fl. Lowland Iraq 202 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 68 (1972).

Shrub, 20–40 cm, yellowish, somewhat whitish tomentose. Stems erect or ascendent, divaricately much-branched from the base. Leaves crowded, minute, suborbicular, 1–1·5 mm long, 1 mm wide, sessile, rounded, densely white tomentose. Flowers solitary, axillary. Perianth segments short, ovate to lanceolate, rounded at tip, with ovate, densely pilose, incurved wings.

The plant is recorded in southern Qatar, where it dominates a community along the road to the United Arab Emirates. It grows on dry salines.

3. *Salsola schweinfurthii* *Solms–Laub.*, Bot. Zeit. 59: 173 (1901); Eig, Pal. J. Bot. Jer. Ser. 3: 132 (1945), Zohary, Fl. Palaest. 1: 173 (1966).

Shrublet with glabrous, white, glossy branches. Leaves fleshy, more or less terete,

0·5–3 cm long ending in a bristle, frequently in clusters and somewhat arcute, lower ones long, upper ones very small, cucullate, hardly or but little exceeding the flowers.
Occasional on salines of southern Qatar.

4. *Salsola soda* *L.*, Sp. Plant., ed. 1, 223 (1753); Boiss., Fl. Orient. 4: 953 (1879); Post, Fl. Syr., Pal. et Sinai, 2: 447 (1933).

Glabrous coastal annuals with semiterete, half-clasping, 1–6 cm long leaves. Segments of perianth pectinate–ciliate at margin. Wings of fruiting-perianth small (about 1 mm) often reduced to transversal keel.
Recorded only in the littoral salt marshes near Al-Khor. Dense growth of young plants cover saline flats which are usually inundated with sea water during high tides.

5. *Salsola vermiculata* *L.*, Sp. Plant., ed. 1, 223 (1753); Boiss., Fl. Orient. 4: 962 (1879); Rech., Fl. Lowland Iraq 202 (1964); Zohary, Fl. Palaest. 1: 174 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 124 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 258 (1978).

Shrubby perennial, greyish-pubescent or yellowish-villose, with long, very slender stiff, yellow branches. Leaves minute, alternate, crowded in small knots. Flowers solitary, axillary. Perianth segments almost free, broadly scarious-margined. Fruit wings small, pale yellow.
A common plant in Qatar. It grows on calcareous stony habitats as well as somewhat saline soils.

13. *SCHANGINIA C. A. MEY.*

Herbs or shrubs, with continuous stem. Leaves very sappy, semiterete, linear–cylindrical. Flowers minute, few in clusters. Perianth urn-shaped, adnate to the ovary, yellowish-green, the five-fruiting lobes furnished with a tubercle, or inflated, or unchanged.
1. *Schanginia aegyptiaca* *(Hasselq.) Aellen*, Rech., Fl. Lowland Iraq 195 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 122 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 260 (1978).
Chenopodium aegyptiacum Hasselq., It. Palaest. 460 (1757). *Schanginia baccata* (Forssk.) Moq. Tand, Chenopod. Monogr. Enum. 119 (1840); Boiss., Fl. Orient. 4: 944 (1879). *Suada baccata* Forssk. ex J. F. Gmel., Syst., ed. 13, 2: 503 (1791); Forssk., Fl. Aegypt.-Arab. 69 (1775). *S. aegyptiaca* (Hasselq.) Zohary, Journ. Linn. Soc. Lond. (Bot.) 55: 536 (1957), Fl. Palaest. 1: 161, t. 235 (1966).

Procumbent herb with extremely sappy, linear 2 cm long leaves. Bracts much longer than flowers, bracteoles minute, scarious. Flowers in clusters arranged in long leafy spikes. Perianth lobes becoming spongy baccate, gibbous-inflated in fruit.
The plant is found on salinized cultivated land, e.g. in farms at Ras Ushirij, Al-Magdah and Abu Samrah. Flowering from June to July. The plant is eaten as green salad with yoghurt. Local name: *Jilban* (Plate 29).

14. *SEIDLITZIA BUNGE EX BOISS.*

Glabrous shrubs with opposite branches and leaves. Leaves fleshy, cylindrical, with a dense tuft of white hairs in the leaf axil. Perianth parts and wings are unequal; the posterior one spoon-shaped, bent forward and covering the fruit, the others spreading.

1. *Seidlitzia rosmarinus* *Bunge ex Boiss.*, Fl. Orient. 4: 951 (1879); Burtt et Lewis, Kew Bull. 1954, 3: 386 (1954); Zohary, Fl. Palaest. 1: 167, t. 243 (1966).

Salsola rosmarinus (Bunge ex Boiss.) Solms–Laub., Bot. Zeit. 59: 171 (1901); Eig, Pal. Jn. Bot. Jer. Ser. 3: 132 (1945).

Richly branched low shrub, up to 60 cm with glabrous white, almost jointed stems; lower internodes longer than upper. Leaves fleshy, thickening towards apex, 10–15 mm long, up to 2 mm wide, obtuse. The old leaves appear quite white and give the appearance of being crusted with salt. Flowers bibracteate, in clusters of 3–5, opposite, in fleecy leaf axils, overtopped by the floral leaves. Fruit winged.

The plant occurs on saline sandy soil in southern Qatar. It grows with *Hammada elegans* and *Zygophyllum quatarense* along the road between Karáanah and Abu Samrah. Local name: *Shinan*; a name given to different *Salsola* spp. Flowering from September to December.

The dried and powdered leaves are used for washing Bedouin's clothes, hair, etc., and make a lather like soap (Plate 30).

15. *SUAEDA FORSSK. EX SCOP.*

Herbs or shrubs with continuous stem. Leaves fleshy, linear (spherical in our species). Flowers perfect or polygamous, with 5-parted or cleft perianth, 5 stamens, and 2–4 stigmas; ovary free from perianth, wings absent.

1. *Suaeda vermiculata* *Forssk. ex J. F. Gmel.*, Syst., ed. 13, 2: 503 (1791); Forssk., Fl. Aegypt.-Arab. 70, Ic 18 B (1775) *nomen illegitimum*: Boiss., Fl. Orient. 4: 940 (1879); Burtt et Lewis, Kew Bull. 1954, 3: 387 (1954); Aellen et Hillcoat, in Rech., Fl. Lowland Iraq 193 (1964); Zohary, Fl. Palaest. 1: 161, t. 231 (1966); Täckh. Stud. Fl. Egypt, ed. 2, 122 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 260 (1978).

Intricately branched low shrub of dark green colour. Branches whitish. Leaves succulent, petioled, the lower obovate–oblong, the upper nearly globular or lenticular, obtuse. Bracts and upper leaves somewhat recurved, becoming black after drying. Flower clusters 1–3 flowered, sessile. Fruiting perianth 1 mm in diameter. Fruit wingless.

The plant is found only in south-west Qatar in the littoral zone dominating a community at Abu Samrah. It forms high phytogenic mounds; usually grazed by camels. Local name: *Suwweid* (Plate 30).

9. *AMARANTHACEAE A. JUSS.*

Herbs or shrubs, with alternate or opposite, simple, entire leaves, without stipules. Flowers small, bisexual or unisexual, in cymose or compound inflorescences. Perianth simple, sepaloid, membranous or scarious, 4–5-merous. Stamens as many as perianth segments. Ovary 2–3-carpelled, with 1–numerous ovules. Fruit a membranous utricle, circumsessile or indehiscent.

1. Densely woolly herbs or shrubs . . . 1. *Aerva*
2. Green herbs, not woolly . . . 2. *Amaranthus*

1. *AERVA FORSSK.*

Woolly herbs or shrubs. Leaves mostly alternate, entire, simple. Inflorescence spike-like or paniculate. Flowers minute, white or rust-coloured, fleecy. Fruit an indehiscent, membranous utricle, included in perianth.

1. *Aerva javanica* *(Burm. f.) Spreng.*, Syst. Veg. 1: 815 (1825); Boiss., Fl. Orient. 4: 992 (1879); Schwarz., Fl. trop. Arab. 43 (1939); Burtt et Lewis, Kew Bull. 7: 351 (1952–53); Aellen in Rech., Fl. Lowland Iraq 215 (1964); Täckh, Stud. Fl. Egypt, ed. 2, 134 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 279 (1978).

Iresine javanica Burm. f., Fl. Ind. 212, t. 64, f. 2 (1768). *I. persica* Burm. f. l.c. *Aerva tomentosa* Forssk., Fl. Aegypt.-Arab. CXXII, no. 584, 170 (1775). *A. persica* (Burm. f.) Merrill in Philipp. Journ. Sci. 19, 348 (1921); Schinz in Engl. et Prantl., Natürl. Pflanzenfam., ed. 2, 16c. 51 (1934).

Densely tomentose dwarf shrub, 15–80 cm. Stems erect, branched, stiff. Leaves flat, elliptic–lanceolate, alternate, short-petioled. Inflorescences many, varying in length, up to 8 cm broad, terminal and axillary, spike-like, sometimes forming leafless panicles.

The plant is common in Qatar. It grows on rocky shallow soils. Flowering from December to June. Local name: *Tirf.*

Woolly spikes formerly used for stuffing saddles and pillows. Plant also utilized in popular medicine. The spikes are locally known as *Tuwaim* (Plate 31).

2. *AMARANTHUS L.*

Annual herbs with alternate, simple, usually entire, green or reddish leaves. Flowers unisexual with 2 herbaceous or scarious, subulate and spinescent bracteoles, borne in axillary or terminal spikes or panicles or congested in the leaf axils. Perianth 3–5-segmented, with scarious margins, not enlarging in fruit. Stamens 3–5. Ovary superior, 1-ovuled. Fruit fleshy or membranous 1-seeded utricle or capsule, the latter dehiscent by an operculum.

I. Flowers all congested in the leaf axils . . . . . 1. *A. graecizans*
II. Flowers in terminal and axillary, spikes or panicles.
  a. Perianth segments 5, fruits dehiscing transversely . 2. *A. hybridus*
  b. Perianth segments 3, fruits indehiscent . . . . 3. *A. viridis*

1. *Amaranthus graecizans* *L.* Sp. Plant., ed. 1, 990 (1753); Zohary, Fl. Palaest. 1: 185, t. 271 (1966); Aellen in Rech., Fl. Lowland Iraq 214 (1964) et in Davis, Fl. Turkey 2: 341 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 133, t. 33 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 279 (1978).

A. angustifolius Lam., Encycl. 1: 115 (1783). *A. angustifolius* ssp. *graecizans* (L.) Thell. in Aschers. et Graebn., Syn. 5, 1: 306 (1914). *A. sylvestris* Desf. var. *graecizans* (L.) Boiss., Fl. Orient. 4: 990 (1879). *A. blitum* L., Sp. Plant., ed. 1, 990 (1753) *pro parte* Moq. in DC., Prodr. 13, 2: 263 (1849).

Monoecious annual, glabrous or nearly so, spreading or ascending. Leaves rhombic–elliptical to ovate or obovate, tapering at both ends, more or less wavy margined,

prominently nerved beneath. Flowers all axillary, overtopped by leaves. Bracteoles 1.2–2 mm, shorter than fruit or subequal to it. Fruit opening by a lid, 2–3-beaked.

The plant is common in Qatar in waste places. Flowering from February to November (Plate 32).

2. *Amaranthus hybridus* L., Sp. Plant., ed. 1, 990 (1753); Zohary, Fl. Palaest. 1: 181, t. 264 (1966). *A. chlorostachys* Willd., Hist. Amaranth. 34, t. 10 f. 19 (1790); Boiss., Fl. Orient. 4: 988 (1879); Aellen in Davis, Fl. Turkey, 2: 341 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 131, t. 33 (1974). *A. hybridus* L. ssp. *hypochondriacus* (L.) Thell. var. *chlostachys* (Willd.) Thell., Mem. Soc. Sci. Cherbourg 38: 205 (1912) et in Aschers. et Graebn., Syn. 5, 1: 236 (1914).

Monoecious annual, greenish or reddish crisp-pubescent to glabrescent. Leaves 3–8 × 2.6 cm, long-petioled, rhombic ovate. Inflorescence erect, terminal, paniculate, composed of numerous long spikes, the lateral ascending, crowded, the terminal erect, much elongated. Bracteoles twice as long as perianth. Flowers white-green. Fruit dehiscent, 2–3-beaked.

A weed in gardens and lawns. Flowering from May to July (Plate 32).

3. *Amaranthus viridis* L., Sp. Plant., ed. 2, 2: 1405 (1763), Aellen in Davis, Fl. Turkey 2: 341 (1970) Täckh., Stud. Fl. Egypt, ed. 2, 133 (1974). *A. gracilis* Desf. Tabl. École Bot. 43 (1804); Aellen in Rech., Fl. Lowland Iraq 215 (1964) et in Davis, Fl. Turkey 2: 341 (1970); Zohary, Fl. Palaest. 1: 186, t. 272 (1966).

Erect, glabrous annual, up to 70 cm, long-branched. Leaves 3–8 × 2–4 cm, ovate to rhomboid-ovate, long-petiolate, more or less wavy margined. Flowers arranged in axillary, many-flowered glomerates and in terminal ones forming leafless spikes. Bracteoles 1 mm, shorter than perianth. Perianth segments 3, stamens 3. Fruit indehiscent, rounded, green or reddish.

The plant is a common weed in Qatar. It has been reported growing profusely in a runnel in the desert along the Doha–Dukhan road where sewage is spilled. Flowering from February to June (Plate 32).

10. *MENISPERMACEAE A. JUSS.*

Twining shrubs. leaves alternate, simple, rarely trifoliate or palmately lobed, exstipulate. Inflorescence cymose, paniculate, in clusters, or rarely the flowers solitary. Flowers small, inconspicuously coloured, dioecious, actinomorphic. Sepals in 2–4 series, imbricate, the outer smaller. Petals usually smaller than sepals, minute or absent. Male flowers: stamens 6, 3 or indefinite, free or variously united. Female flowers: staminodes present or absent; carpels 1 or several, free, sessile ovules 2, soon reduced to 1 by abortion. Fruiting carpels drupaceous, often horseshoe-shaped.

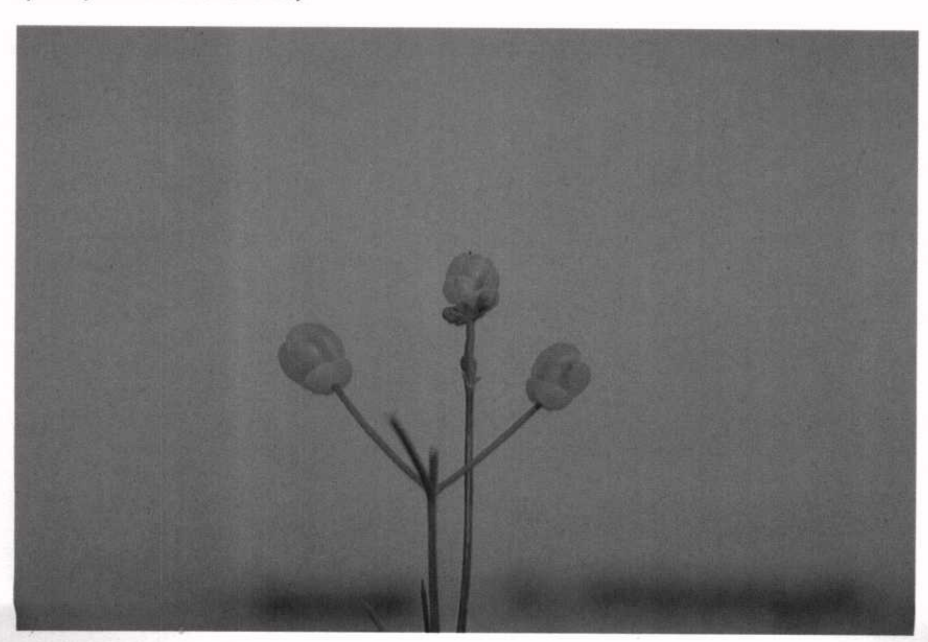
1. *COCCULUS DC.*

Climbing dioecious shrub with yellow-green 6-fid flowers and red berries.

1. *Cocculus pendulus* (J. R. et G. Forst.) Diels. in Engl., Pflanzenfam. 4: 237 (1910);



Ephedra foliata Boiss. ex C.A. Mey.



Ephedra foliata Boiss. ex C. A. Mey.



Emex spinosus (L.) Campd.

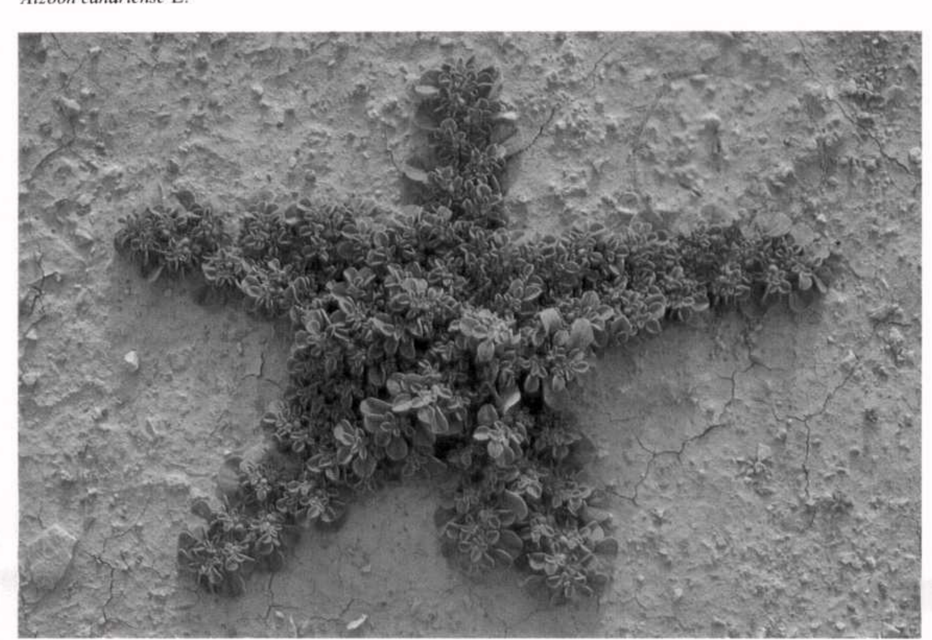


Rumex vesicarius L.

Plate 18



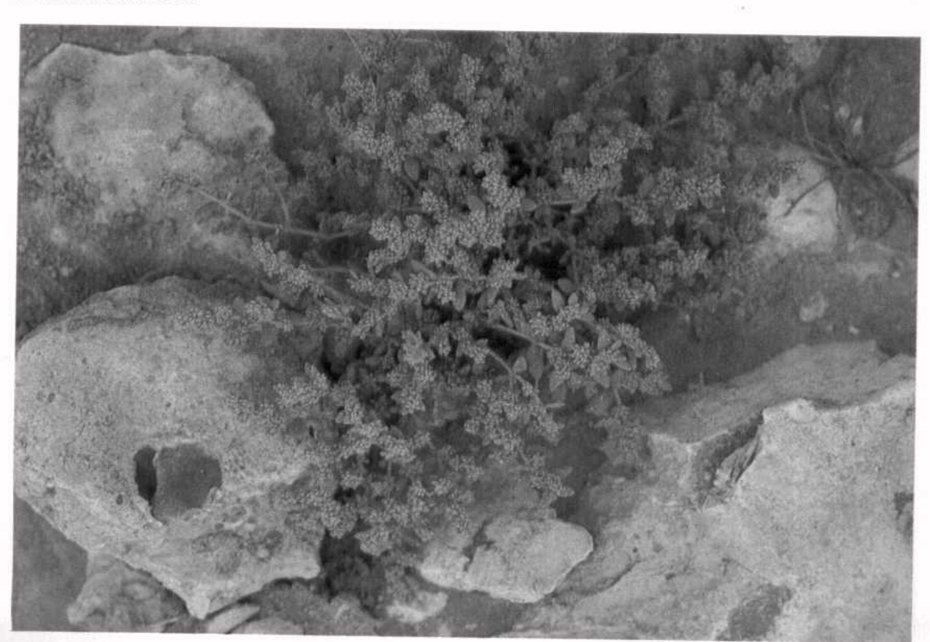
Aizoon canariense L.



Aizoon canariense L.

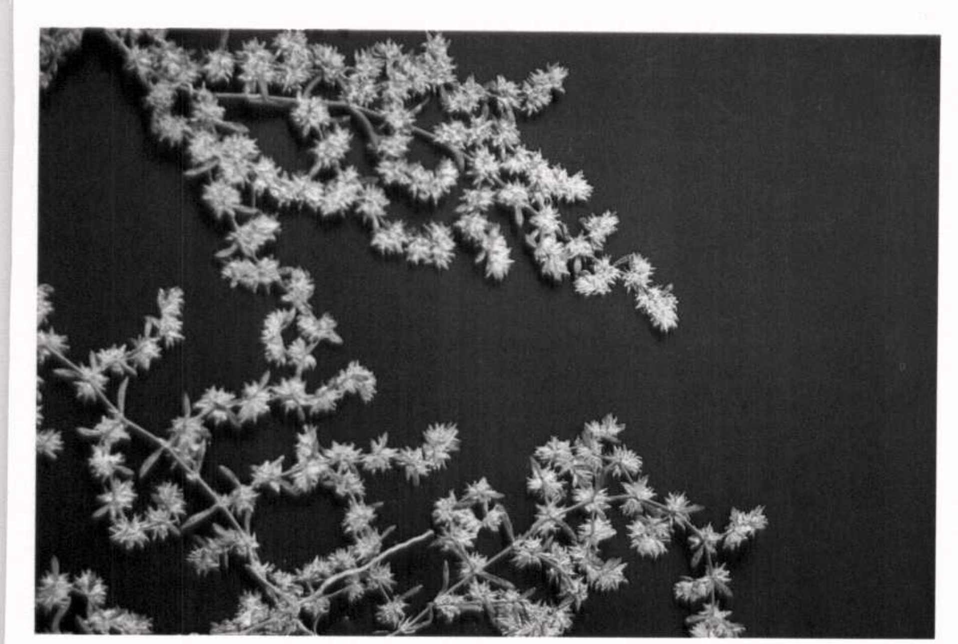


Portulaca oleracae L.



Herniaria hemistemon J. Gay.

PLATE 20



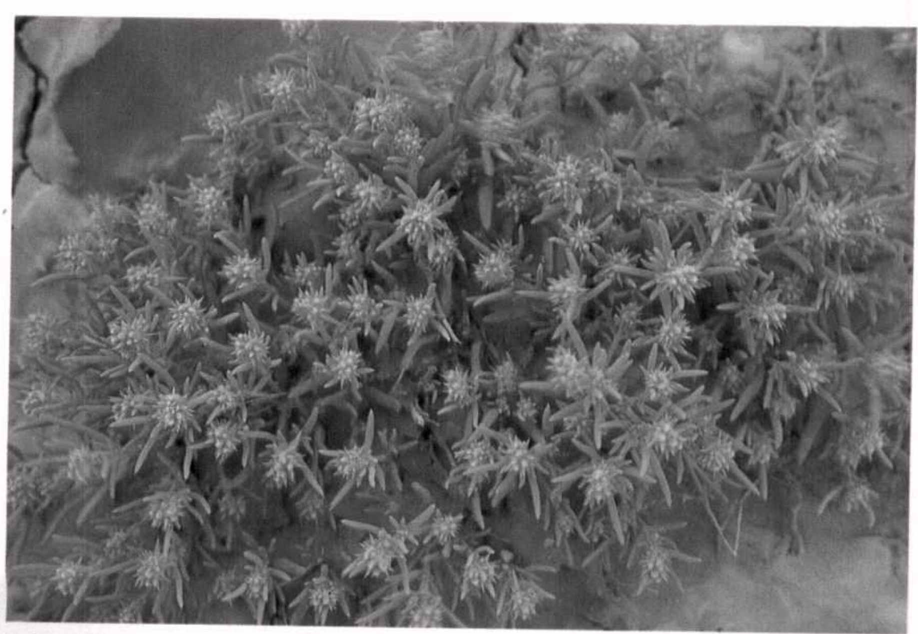
Paronychia arabica L.



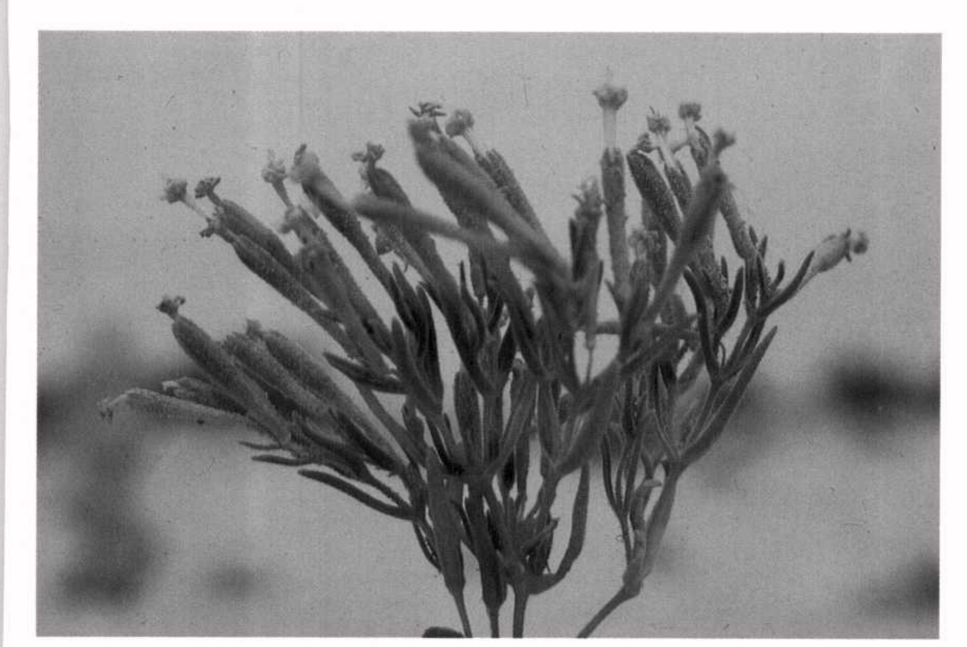
Polycarpaea spicata Wight ex Arn.



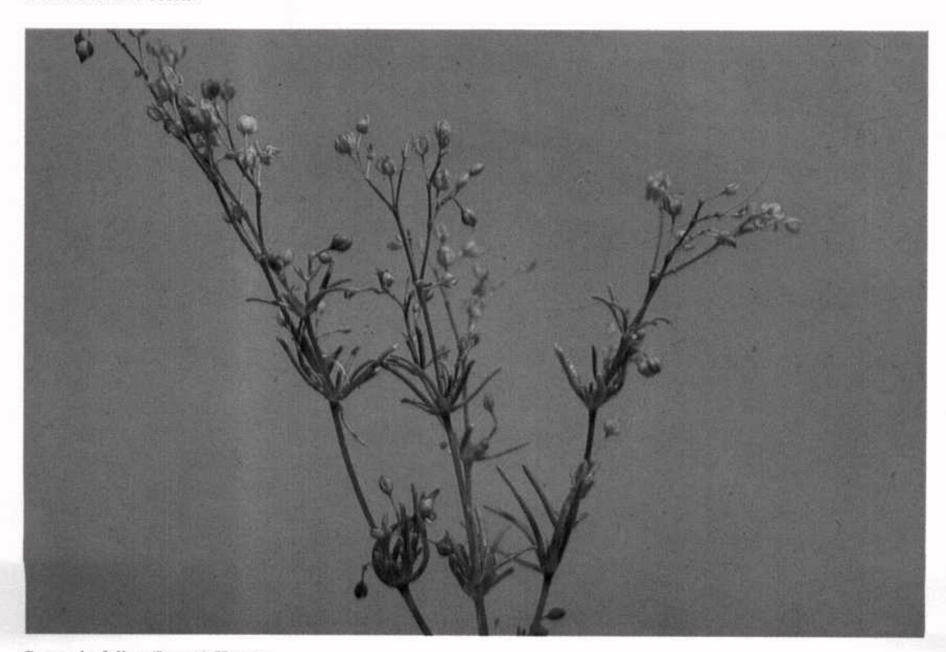
Robbairea delileana Milne-Rodh.



Sclerocephalus arabicus Boiss.



Silene villosa Forssk.



Spergula fallax (Lowe) Krause.



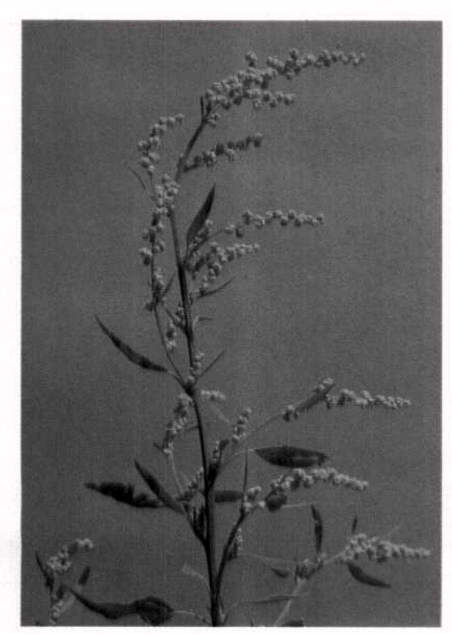
Anabasis setifera Moq.



Arthrocnemum glaucum (Del.) Ung. Sternb.



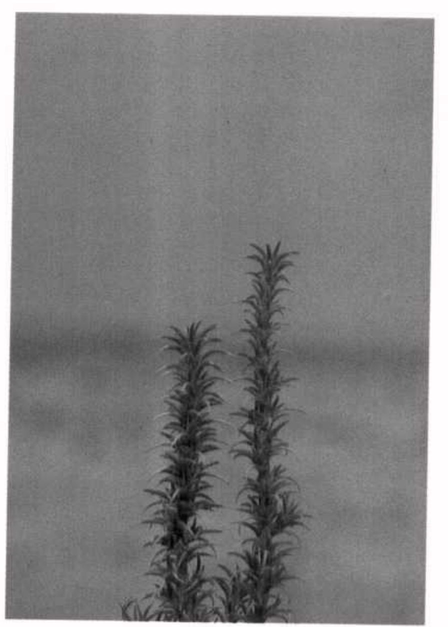
Atriplex leucoclada Boiss.



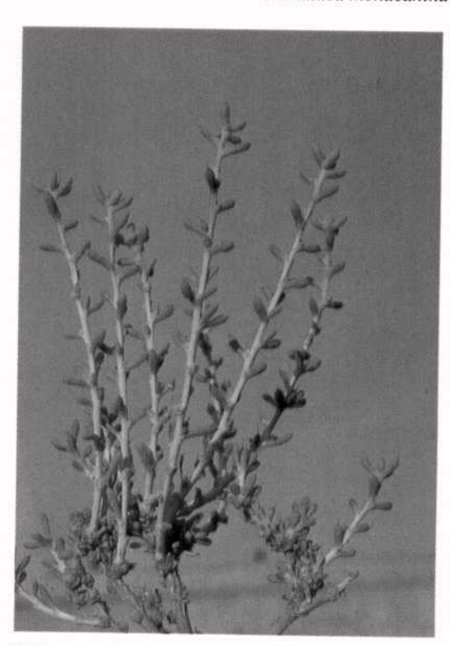
Chenopodium album L.



Chenopodium murale L.

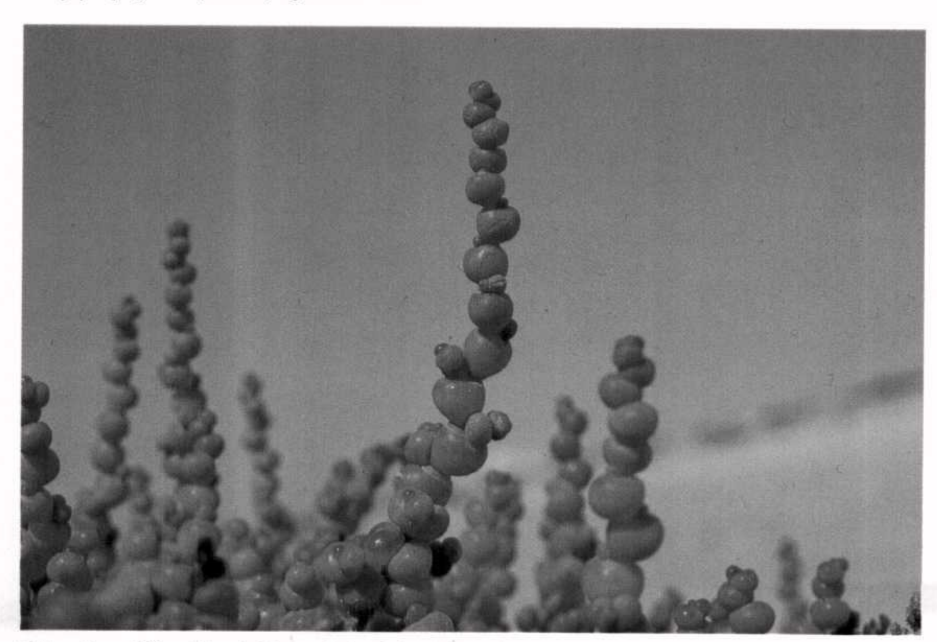

Cornulaca aucheri Moq.


Cornulaca monacantha Del.


Halogeton alopecuroides (Del.) Moq.



Halopeplis perfoliata (Forssk.) Bg. ex Schweinf.



Halopeplis perfoliata (Forssk.) Bg. ex Schweinf.

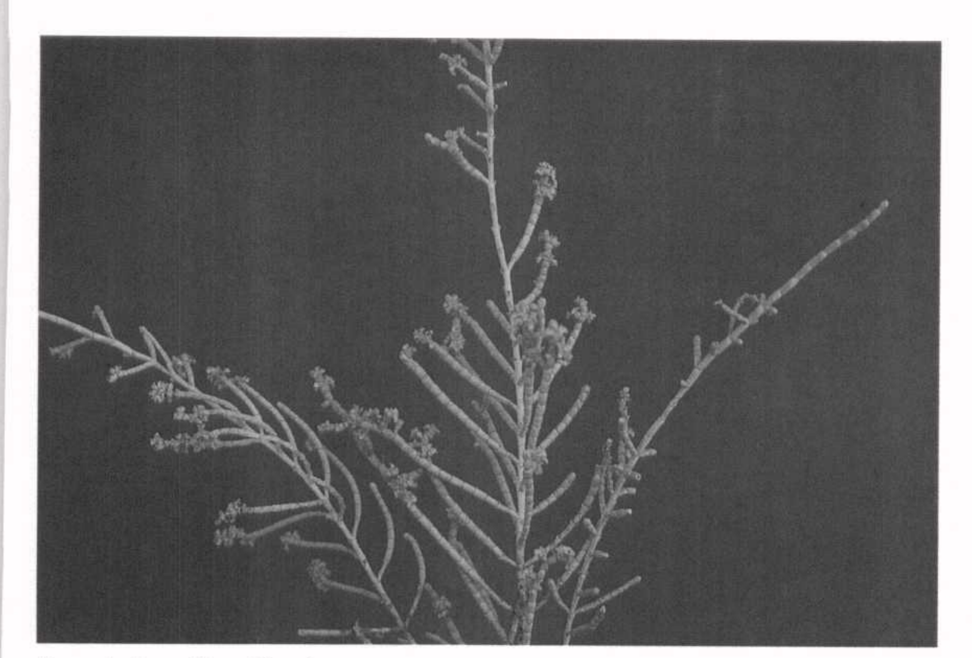


Salsola baryosma (Roem et Schult). Dandy.



Salsola baryosma (Roem et Schult.) Dandy.

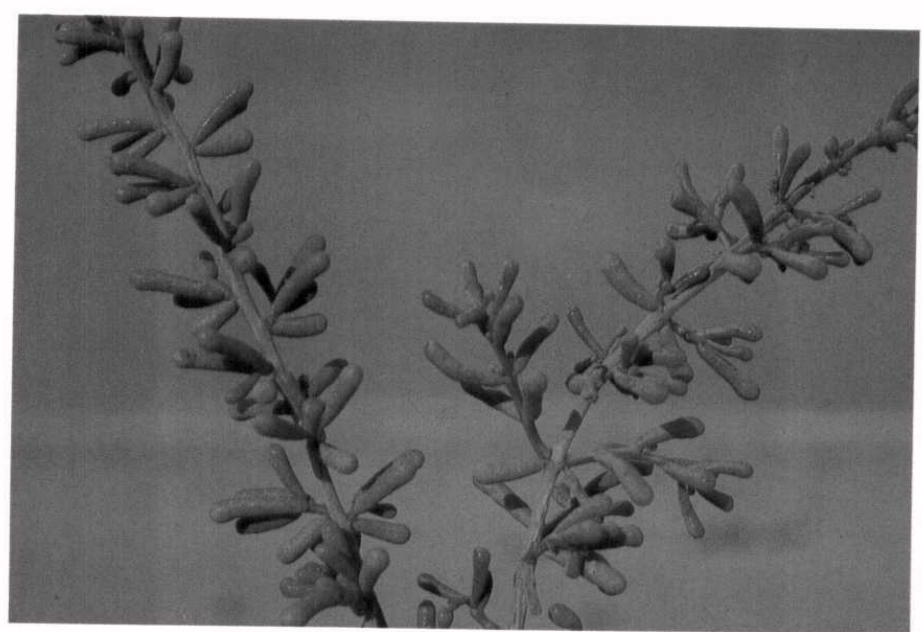
PLATE 28



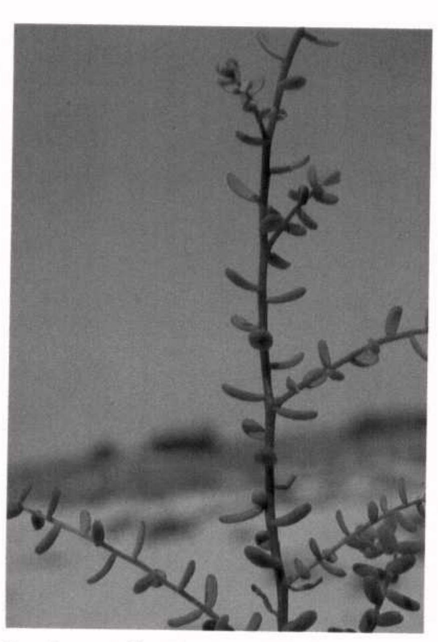
Hammada elegans (Bunge) Botsch.



Schanginia aegyptiaca (Hasselq.) Aellen.



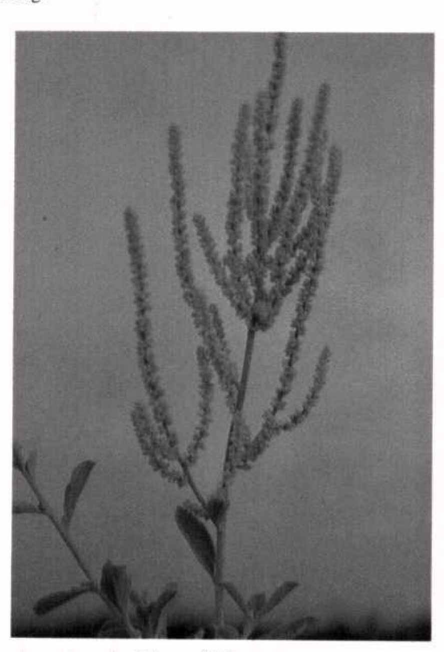
Seidlitzia rosmarinus Bunge ex Boiss.



Suaeda vermiculata Forssk. ex. J. F. Gmel.



Aerva javonica (Burm. f.) Spreng.



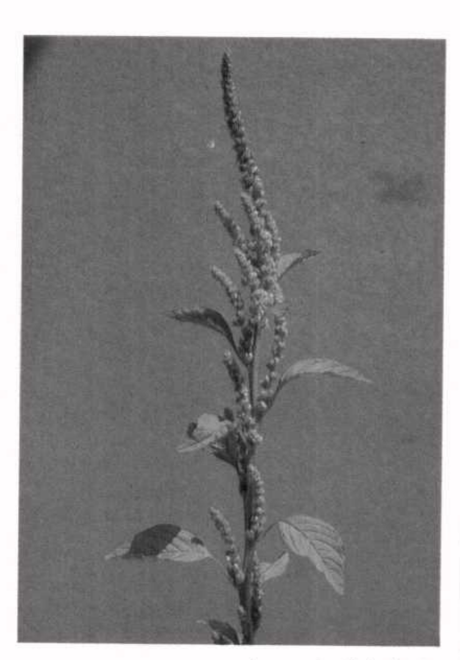
Aerva javonica (Burm. f.) Spreng.



Amaranthus graecizans L.



Amaranthus viridis L.



Amaranthus hybridus L.

PLATE 32

Täckh., Stud. Fl. Egypt, ed. 2, 144, t. 38 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 34 (1978).

C. leaeba (Del.) DC., Syst. 1: 529 (1817).

Climbing shrub, sometimes prostrate or straggling, branches elongate, slender, glabrous, finely striped. Leaves variable, ovate to lanceolate, entire or obscurely lobed, glabrous. Male flowers in axillary clusters. Female flowers solitary or in pairs. Fruiting-carpels red, subglobose.

Rare in Qatar; recorded climbing *Ziziphus nummularia* trees at Al-Kharrarah and Al-Wabrah. Flowering from March to April (Plate 40).

11. *PAPAVERACEAE A. JUSS.*

Annual or perennial herbes with milky or yellow juice. Leaves alternate, exstipulate, usually deeply lobed or divided. Flowers bisexual, actinomorphic, hypogynous. Sepals 2, rarely more, caducous. Petals 4–6, showy. Stamens numerous, free. Ovary superior, syncarpous, of 2–18 united carpels, 1-loculed; the numerous ovules on parietal placentae.

1. *PAPAVER L.*

Annual or perennial herbes with usually milky juice. Leaves pinnately lobed. Flowers solitary, large. Sepals 2, soon deciduous. Petals 4, showy. Stamens numerous. Fruit an ovoid or club-shaped capsule, crowned by an orbicular lobed disc where the lobes represent stigmas. It opens by pores under these stigmas.

1. *Papaver syriacum* *Boiss. et Bl.*, Diagn. Ser. 2, 4: 8 (1859); Post, Fl. Syr, Pal. et Sinai, ed. 2, 1: 34 (1932).

This species has not been recorded by the author. Boulos (1978) recorded it in the State Guest Palace garden, Doha.

Annual, many-stemmed from the base. Basal leaves long-peduncled, pinnatipartite; stem-leaves with narrow segments, upper linear–lanceolate, serrate. Petals very wide, purple, with a black spot at or above the base. Capsule glabrous at base. Disc conical, with 7–10 rays not reaching the margin. Flowering and fruiting in April.

12. *CAPPARACEAE A. JUSS.*

Shrubs or herbs with alternate leaves, stipules spiny or absent. Flowers hypogynous, more or less zygomorphic, with 4 sepals and 4 petals; stamens 6, indefinie or 4 (not tetradynamous). Ovary often borne on a gynophore, 2 or more carpellate, with parietal placentation. Fruit a capsule or berry-like.

1. *CAPPARIS L.*

Straggling shrubs with simple, entire leaves, with or without stipular spines. Flowers

showy, with 4 sepals, 4 petals, very many free stamens and an ovary borne on a stipe becoming much elongated in fruit. Fruit a berry-like or many seeded capsule.

1. *C. spinosa* *L.* var. *aegyptia* (Lam.) *Boiss.*, Fl. Orient. 1: 420 (1867). *C. aegyptia* Lam., Encycl. 1: 605 (1785); Del., Fl. Egypte Ill. 237 (1813); Täckh., Stud. Fl. Egypt, ed. 2, 164 (1974).

Shrub with long, decumbent or ascending, smooth, glabrous, often purplish branches. Leaves usually 1·5–2·5 cm, deciduous, not fleshy, orbicular, rounded or retuse at apex with a small mucro or prickle. Stipular spines well-developed and backwardly directed. Flowers axillary, solitary, long-pedicelled, showy, white or tinged mauve. Sepals glabrous, the two outer sepals deeply concave, the inner pair rather smaller. Anterior petals 2 × 1·5 cm, obovate or orbicular, elongating after anthesis. Stamens numerous with filaments longer than the petals, anthers violet. Ovary cylindrical, about 5 mm long and 1·5 mm wide; gynophore 1·5–2·5 cm or more long. Fruit ovoid or ellipsoid, about 2·5–4 cm long and 1·5–2·5 cm wide; eipcarp rather leathery, distinctly 5–6 ribbed, greenish, turning reddish when fully ripe; seeds numerous, reniform.

Very common in the *rodat* in northern Qatar on deep alluvial soil. The plant growth in these *rodat* is dominated by *Ziziphus nummalaria*. Flowering from March to May. Local name: *Shafallah*. This name is used throughout the Arab countries for the various *Capparis* species (Plate 33).

13. *CLEOMACEAE* (*PAX*) *AIRY-SHAW*

Herbs or subshrubs. Leaves alternate, simple or digitate, glandular. Flowers zygomorphic. Stamens few to many, rarely tetradynemous. Fruit a capsule with persistent replum.

1. *CLEOME* L.

Annual or perennial herbs or undershrubs. Leaves simple or composed of 3–7 leaflets. Flowers bisexual, solitary or in racemes, white, yellow or purple. Sepals 4, free or connate, sometimes caducous. Petals 4. Stamens 4 to numerous, inserted on a torus or a short androphore. Ovary more or less short stipulate, 2-carpelled, 1-loculed with a replum. Fruit a capsule, opening by 2 membranous valves separating from replum.

I. Leaves digitate . . . 1. *C. brachycarpa*
II. Leaves simple . . . 2. *C. scaposa*

1. *Cleome brachycarpa* *Vahl ex DC.*, Prodr. 1: 240 (1824); Hedge et Lamond in Rech., Fl. Iran. 68/30: 20 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 169 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 59 (1978).

Perennial or potential annual, erect, herbaceous plant. Leaves digitate. Flowers in racemes, dirty yellow. Fruit small, 1 cm long, oblong, with glabrous seeds.

Rare in Qatar; recorded abundant in a locality near Al-Khor. It grows in the shallow depressions in the limestone plateau between Al-Khor and the littoral salt marshes along the eastern shore. Flowering from February to April (Plate 34).

2. *Cleome scaposa* *DC.*, Prodr. 1: 239 (1824); Hedges et Lamond in Rech., Fl. Iran. 68/30: 15 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 169 (1974).
C. papillosa Steud., Nomencl. Bot., ed. 2, 1: 382 (1840).

Annual (sometimes perennial), glandular hispid herb with simple ovate 20 × 17 mm leaves on long petioles. Upper leaves small. Inflorescence lax, ebracteate. Flowers small, brownish yellow. Sepals 1·5–2 mm long, elliptic. Petals 3–4 × 1·5 mm, obvate or elliptic. Stamens 6. Fruit 20–35 mm long, 1–2 mm broad, slightly curved, on a capillary stiff patent pedicel. Seeds minute, 0·5 mm diameter, black, glabrous.

Of limited distribution in Qatar. It has been recorded on stony slopes 25 km north of Doha along the road to northern Qatar, also in a garden in Doha. Flowering from July to October (Plate 35).

14. *CRUCIFERAE* *A. JUSS.*

Annual or perennial herbs, sometimes shrubby or woody at base. Leaves usually alternate, exstipulate, often forming a basal rosette. Hairs simple, branched or stellate. Inflorescence racemose (mostly corymbose), usually ebracteate. Flowers bisexual, actinomorphic. Sepals 4, in 2 decussate whorls. Petals 4, free, clawed. Stamens 6, tetradynamous. Ovary superior, 2-carpelled; placentation parietal. Fruit a siliqua or a silicle.

I. Fruit a siliqua (i.e. at least 3 times as long as broad).
A. Flowers purple or pink . . . . 4. *Erucaria*
B. Flowers yellow or white.
1. Petals dark-veined.
a. Pod indehiscent, disseminating in numerous joints, lower joint inconspicuous, seedless, the upper over 2 cm long 7. *Raphanus*
b. Pod dehiscent, 2-valved, terete, long-beaked . . . . 3. *Eruca*
2. Petals veinless.
a. Pod beakless . . . . 11. *Sisymbrium*
b. Pod beaked.
\+ Flowers 6–8 mm across, pale yellow. Fruit (including beak) 4·5–9 cm; valves of the pod 1-nerved . . . . 2. *Brassica*
\+ + Flowers 1·1–5 cm across, intensely yellow. Fruit shorter than in above, valves of the pod several-nerved . . . . 10. *Sinapis*
II. Fruit a silicle (i.e. at most twice, rarely $2\frac{1}{2}$ times as long as broad).
A. Pod compressed with the wall perpendicular on the flat side, valves 1-seeded . . . . 6. *Lepidium*
B. Pod compressed with the wall parallel to the flat sides, ovate or broadly elliptical; seeds winged.
1. Perennial plants, fruit appressed-pubescent . . . . . 5. *Farsetia*
2. Annual plants, fruit glabrous . . . . 8. *Savignya*
C. Pod not or inconspicuously compressed.
1. Spiny desert shrub with pink flowers, fruit almost globular, with spiny beak . . . . 12. *Zilla*
2. Annual with yelow flowers, fruit 1-seeded, with oblique flattened beak longer than fruit proper . . . . . . 9. *Schimpera*
D. Pod woody with a long spiny style between the small auricled valves, annual with white flowers. . . . . 1. *Anastatica*

1. *ANASTATICA* L.

Small stellate–canescent annual herb, becoming woody. Stems dichotomously branched. Leaves simple, petiolate. Flowers axillary, small, white, subsessile. Pod woody, with a spoon-shaped appendage at apex, style long, spinescent, persistent, between the 2 short valves. Fruit indehiscent when dry but dehiscing when wet.

1. ***Anastatica hierochuntica*** L., Sp. Plant., ed. 1, 641 (1753); Boiss., Fl. Orient. 1: 316 (1867); Rech., Fl. Lowland Iraq 302 (1964); Zohary, Fl. Palaest. 1: 276 (1966); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 70 (1972); Zohary, Fl. Palaest. 1: 276 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 183 (1974); Migahid, Fl. Saudi Arab., ed. 2, 72 (1978).

Annual decumbent herb, stellately hairy, canescent, mostly a few centimetres high. Stems dichotomously branched; becoming hard and woody in fruits, often rolled inwards under dry conditions. Leaves small, spathulate–obovate, tapering to a petiole, obtuse or acute, remotely dentate, most of them falling after flowering. Flowering racemes mostly in forks between branches, overtopped by leaves. Flowers more or less sessile. Sepals stellate hirsute, 2 cm long. Petals about twice as long as calyx clawed. Fruiting branches elongated, woody, often rolled inwards and forming a globular body enclosing fruits; when moistened the branches diverge and spread exposing the fruits to the rain and wind. Fruit 5–6 × 3–4 mm, indehiscent, ovoid, stellate hirsute; valves extended at apex into broad spoon-shaped appendage equal to or shorter than the 2–5 mm long, persistent style. Seeds *ca.* 1·5 mm, ovoid, wingless, pendulous.

The plant is common in Qatar. It grows in gravelly or shallow sandy depressions and along the margins of runnels leading to the *rodat*.

Local name: *Kaff Maryam*, a name used throughout the Arab World. Flowering from February to April. The dry plant is reputed for its medicinal value in the Arabic folk medicine. It is usually sold in the markets (folk drug shops) in Qatar as well as countries of the Arabian peninsula. It is specially used by women as a charm at childbirth. The plant is soaked in water and, when it has unfurled, the water is drunk by the expectant mother (Plate 36).

2. *BRASSICA* L.

Annual biennial or perennial herbs, roots, mostly fusiform. Leaves simple or pinnately lobed; radicle leaves rosulate, cauline leaves alternate. Flowers in terminal racemes, mostly yellow, rarely white. Inner sepals saccate at base. Petals clawed. Siliquae beaked, subcylindrical to torulose, many-seeded; beak with or without seeds. Upper part of the fruit (beak-shaped) indehiscent. Seeds in 1-row, wingless.

In addition to two species of *Brassica* growing wild as weeds in Qatar, *B. oleracea* L. is cultivated for its several varieties used as vegetables, such as cabbage, *Krumb* or *Malfouf* (var. *capitata* L.), cauliflower *Zahrah* (var. *botrytis* L.). Also, *B. rapa* L. *Lift* is cultivated in Qatar.

A. Leaves not rosetted, glabrous or nearly so . . . 1. *B. arabica*
B. Leaves rosetted, hispid . . . . 2. *B. tournefortii*

1. ***Brassica arabica*** *(Fisch. et Mey.) Fiori.* Täckh., Stud. Fl. Egypt, ed. 2, 190 (1974).
Erucastrum arabicum. Fisch. et Mey., Linnaea 13; Boiss., Fl. Orient. 1: 389 (1867). *B. schimperi* Boiss., Ann. Sc. Nat., Sec. 2, 17: 86 (1842).

Erect branched, leafy annual herb, glabrous, or nearly so. Leaves neither clasping, nor rosetted, varying from entire to shallowly lobed. Flowers small, pods 3–4 cm long, often slightly curved, spreading, pedicels about 10 mm long.

Rare in Qatar and grows as a weed in permanently irrigated gardens. Flowering from April to May.

2. ***Brassica tournefortii*** *Gouan*, Illustr. Observat. Bot. 44, t. 20A (1773); Boiss., Fl. Orient. 1: 393 (1867); Rech., Fl. Lowland Iraq 285 (1964); Davis, Fl. Turkey 1: 265 (1965); Zohary, Fl. Palaest. 1: 309, t. 457 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 190 (1974); *B. stocksii* Hook. f. et Thoms. in Journ. Linn. Soc. Bot. 5: 171 (1861). Migahid, Fl. Saudi Arab., ed. 2, 1: 91 (1978).

An erect annual herb, up to 70 cm tall, dichotomously branched, almost aphyllous above, ciliately hairy below, often violet-tinged above. Radical leaves 7–20 (–40) cm, rosulate, petiolate, lyrate–pinnatisect. Upper leaves small, distant, oblong–linear. All leaves more or less hispid, especially on midrib. Inflorescence terminal and lateral, loosely racemose, 10–20 flowered. Flowers pale yellow. Flowers pale yellow. Calyx 3–4 mm, green or somewhat violet. Petals 6–8 mm, linear or oblong, obtuse; long-clawed. Fruiting racemes elongated, loose. Fruiting pedicel 1–4 cm, spreading. Fruit 3·5–6·5 × 0·2–0·3 cm, erect or ascending, forming an obtuse angle with the pedicel, torulose, glabrous, with 1–2 seeded beak 1–2·5 cm long, somewhat narrower than fruit. Seeds 1–2 mm in diameter, purplish-brown, ovoid globose; testa minutely foveolate.

A weed in gardens. Flowering from March to May.

3. *ERUCA MILL.*

Herbs with pinnatifid or pinnatisect leaves. Lower leaves petiolate, upper subsessile or sessile. Racemes ebracteate, much elongated in fruit. Pedicels shorter than calyx, thickened in fruit. Flowers 1·5–2 cm. Sepals about 1 cm, glabrous or somewhat pilose, sometimes coloured. Petals long-clawed, white or yellow or occasionally purplish, often with conspicuous dark venation. Stamens 6, stigma bilobed. Siliquae straight, narrowly oblong or ellipsoid; valves convex, 1-nerved; beak sword-shaped, flattened, seedless. Seeds biseriate in each locule, subglobose to ovoid; brown or reddish-yellow.

Differs from *Sinapis* by its erect sepals, inner subsaccate at the base, silique valves 1-veined, seeds 2-seriate in each locule.

1. ***Eruca sativa*** *Mill.*, Gard. Dict., ed. 8, no. 1 (1768); Boiss., Fl. Orient. 1: 396 (1867); O. E. Schulz in Engl., Pflanzenr. 70 (IV, 105): 181 (1919); Post, Fl. Syr. Pal. et Sinai, ed. 2, 1: 124 (1932); Rech., Fl. Lowland Iraq 289 (1964); Davis, Fl. Turkey 1: 269 (1965); Zohary, Fl. Palaest. 1: 313, t. 462 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 192 (1974), Jafri, Fl. Lib. 23: 39 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 61 (1978).
Brassica eruca L., Sp. Plant., ed. 1, 667 (1753).

Erect or spreading annual or biennial, 15–40 cm or more high; stems distinctly striate, glabrous or rather thinly hispidulous especially towards the base. Lower leaves up to 15

cm, petiolate, sometimes forming a rosette, upper leaves shorter, sessile. Raceme lax, elongating in fruit; pedicels 2–5 mm long. Sepals narrowly oblong, 8–12 mm long, about 2 mm wide, acuminate. Petals pale yellow or white, with dark veins, obovate, about 15–22 mm long, 4–8 mm wide, apex obtuse or slightly emarginate; base narrowed to a long, slender claw. Stamens 10–14 mm long. Style 6–7 mm long, usually longer than the ovary. Siliquae ascending or erect, 1·5–3 cm long (including beak), 2–5 mm wide; beak 6–10 mm long, flattened, round-shaped; valves distinctly or obscurely 1-nerved; seeds broadly ovoid 1·5–2·5 mm long, pale-brown.

A weed in gardens, escaped from cultivation. The cultivated plant is used as a salad. Flowering from February to June. Local name: *Gargir*.

4. *ERUCARIA* GAERTN.

Annual herbs with erect or spreading, glabrous or thinly hispidulous stems; leaves scattered, generally pinnatisect or irregularly laciniate. Inflorescence ebracteate, at first rather densely corymbose, elongating greatly in fruit. Sepals erect, oblong. Petals mauve, purplish or white, obovate, with a slender claw. Stamens 6; ovary narrowly cylindrical; style usually distinct; stigma capitate. Siliqua longitudinally nerved, transversely 2-jointed; low joint cylindrical, dehiscent, 2-valved, 1–8 seeded; upper joint ovoid, indehiscent, 1–4 seeded, terminating in a beak. Seeds oblong or ellipsoid, brown.

1. *Erucaria crassifolia* *(Forssk.) Del.*, Fl. aegypt. Ill. 20, t. 34 (1813); Rech., Fl. Lowland Iraq 292 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 194 (1974).

Annual herb, glabrescent, often violet purple. Lobes of lower leaves distant, oblong–linear, entire or sparingly dentate, those of the upper ones filiform, entire. Flowers 7–8 mm long, purplish or white, sweet-scented. Pod slowly tapering into a conical style. Upper joint ensiform, twice as long as the lower one; lower joint cylindrical, many-seeded.

Fairly common in northern Qatar, particularly in *rodat* receiving considerable runoff water. Flowering from March to April (Plate 37).

5. *FARSETIA* TURRA

Perennial herbs or undershrubs, mostly canescent, with forked, stiff, adpressed hairs. Leaves linear–oblong, sessile, entire. Racemes lax, ebracteate, enlongated in fruit. Flowers yellowish, brownish, violaceous, pinkish or white, shortly pedicelled. Sepals erect, more or less equal at base. Petals slightly twice as long as the sepals, linear–oblong, margin often crimped, limb often circinate. Stamens 6. Fruit a siliqua or silicle, dorsally flattened, ovate–oblong to linear–elliptical dehiscing by 2 flat or convex valves. Seeds many, in 1–2 rows in each locule, almost orbicular, brown, broadly winged.

1. *Farsetia hamiltonii* *Royle*, Ill. Bot. Himal. 1: 71 (1834); Hook. f. et Thoms, Journ. Linn. Soc. Bot. 5: 148 (1861); Blatter, Fl. Arab. 8(1): 15 (1919).

F. linearis Decne, Ann. Sc. Nat. 150 (1842); Boiss., Fl. Orient. 1: 158 (1867); Good, in Dickson, The Wild Flowers of Kuwait and Bahrain 130 (1955).

F. arabica Boulos, Webbia 32(2): 379 (1978).

Perennial, canescent herb, often woody at base. Leaves linear, very variable, 1–4 × 0·1–0·3 cm, subsessile, entire. Inflorescence 5–20-flowered, lax, ebracteate racemes; pedicels 2–3 mm long, ascending. Flowers about 5 mm across, white or pink. Petals 6–7 mm long, oblong, apex-rounded. Siliqua 11–35 × 2–3 mm, oblong, compressed. Seeds uniseriate, with membranous wing.

The colour of the fresh flowers is either white or pale pink, but on drying it appears to be orange.

A rare plant in Qatar, usually occurring on stony ground. Flowering throughout the year.

6. *LEPIDIUM* L.

Herbs, sometimes woody below; stems erect or decumbent, glabrous or with simple hairs. Leaves mostly linear or elliptic, entire, toothed or pinnatifid, lower often petioled, upper subsessile or sessile. Racemes ebracteate, corymbose at first and elongating in fruit. Flowers small, white or pinkish, sometimes yellowish; pedicels usually filiform. Sepals not saccate at the base. Petals linear to spathulate. Stamens 6, 4 or 2. Siliculae small, laterally compressed, 2-locular, often notched at the apex. Seeds 1 in each locule (or rarely 2) ellipsoid or ovoid.

1. ***Lepidium aucheri*** *Boiss.*, Ann. Sci. Nat. Bot. Ser. 2, 17: 195 (1842) et Fl. Orient. 1: 354 (1867); Rech., Fl. Lowland Iraq 296 (1964); Zohary, Fl. Palaest. 1: 301, t. 446 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 202 (1978); Migahid, Fl. Saudi Arab., ed. 2, 1: 71 (1978).

Annual, subglabrous herb. Stems 5–50 cm, prostrate, numerous, thick, unequal from base. Radicle leaves up to 5 cm, rosulate, lyrate pinnatifid; cauline leaves smaller, subsessile, oblong–spathulate. Inflorescence terminal and axillary, small, dense. Flowers about 2 mm, white to cream coloured. Fruiting pedicels adpressed to rachis, hygrostatic. Fruit about 3 mm, ovate–subcordate to quadrangular, shortly and narrowly winged at apex, with small V-shaped notch and style shorter or longer than sinus. Seeds solitary in each locule.

Rare in Qatar, on alluvial soil in depressions. Flowering from March to April.

7. *RAPHANUS* L.

Annual, biennial (or rarely short-lived perennial) herbs; with tuberous roots. Stems erect, branched. Leaves lyrate, pinnatisect. Racemes terminal or axillary, many-flowered, ebracteate. Flowers white, yellow or violet, often purple-veined. Calyx erect; the inner sepals saccate at base. Petals long-clawed, obovate. Fruit elongate, 2-joints: the lower joint mostly sterile, narrow, very short and thin, resembling pedicel, top-shaped: upper joint thick, long, indehiscent or breaking into single-seeded portions; beak seedless. Seeds spherical, brown.

1. ***Raphanus sativus*** *L.*, Sp. Plant., ed. 1, 669 (1753); Boiss., Fl. Orient. 1: 400 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 127 (1932); Rech., Fl. Lowland Iraq 289 (1964).

Herbs up to 1 m high, with a fleshy fusiform taproot; stems glabrous or very sparsely hispid; leaves rather fleshy, often with reddish veins. Petals mauve, pink or purple

(occasionally white). Fruit spreading or ascending, oblong–conical, somewhat inflated, 3–6 cm or more long (including beak), 5–20 mm wide, smooth or obscurely rigid, spongy internally, not markedly constricted between the seeds nor breaking into 1-seeded joints; beak slender, subulate, 1–3 cm long; seeds broadly ovoid, about 3 mm long, brown.

Cultivated and escaping cultivation. Local name: *Fijl*.

8. *SAVIGNYA DC.*

Annual herbs. Lower leaves ovate–oblong, sinuate–dentate, shortly stalked; upper leaves oblong to linear, subsessile or sessile with rounded or obtuse apices. Siliculae flattish, oblong or elliptic, bladder-like, with a filiform style; valves opening parallel to the flat sides. Seeds white-winged at the margin.

Probably a monotypic genus from the desert or arid areas of North Africa eastwards to Pakistan.

1. ***Savygnia parviflora*** *(Delile) Webb.*, Fl. Aethiop.-Aegypt. in Parlatore, Giorn. Bot. Ital. 2: 215 (1847); Täckh., Stud. Fl. Egypt, ed. 2, 200 (1974).

Lunaria parviflora Del., Fl. Egypte, 104, t. 35, f. 3 (1812).

Savignya aegyptiaca DC., Syst. Nat. 2: 283 (1821); Boiss., Fl. Orient. 1: 397 (1867); Carter, Rec. Bot. Surv. Ind. VI, 6: 185 (1917).

Farsetia parviflora (Del.) Spreng., Syst. Veg. 2: 871 (1825).

Savignya parviflora spp. *aegyptiaca* (DC.). Maire, var. *intermedia* Maire, in M.C. 65 (1929); Maire, Fl. Afr. Nord. 13: 30 (1967).

Annual herb, up to 30 cm tall, branched mostly from the base; glabrous or subglandular, sometimes glaucus. Leaves fleshy or subfleshy, lower 2–6 × 1–2 cm, upper 10–25 × 1–4 mm. Flowers white, pink-violaceous to reddish-lilac, very variable in size and colour. Pedicles up to 3 cm long in fruit, filiform, lower mostly pendulous. Silicula flat, compressed, beak 1·5–3 mm long, gynophore up to 3 mm long; seeds 2·5–3 mm in diameter including the membranous marginal wing.

Common on sandy and pebbly soils. Carter (1917) gives its name at Zor Hills as *Gulgulan* or *Gulijalan*. Flowering from February to April. Obeid (1975) reports the local name in Qatar as *Girgees* (Plate 37).

9. *SCHIMPERA HOCHST. ET STEUD.*

Herbs with rosulate, runcinate–dentate or pinnatifid root-leaves. Flowers minute, yellow. Silicles small, indehiscent, ovoid and tubercled, adpressed to the stem but with a narrow, patent, long beak.

1. ***Schimpera arabica*** *Hochst. et Steud.* in Schimp., Pl. Arab. Exsicc. No. 244 (1835); Burtt et Lewis, Kew Bull. 4: 297 (1949); Rech., Fl. Lowland Iraq 303 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 178 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 62 (1978).

S. persica Boiss., Diagn. Ser. 1, 6: 18 (1845).

Annual, stiff-scabrous herb. Basal leaves pinnatifid, stem leaves simple, sagittate. Pedicels short, thick, erect, the patent beak about 3 times as long as the pod, giving the raceme a pectinate aspect.

Rare in Qatar; it grows in sand. Flowering from March to April.

10. *SINAPIS* L.

Annual herbs, very similar to *Brassica* in general appearance but with the valves of the silique distinctly 3–7-nerved, the lateral nerves often as distinct as the median.

1. *Sinapis arvensis* *L.*, Sp. Plant., ed. 1: 668 (1753); Boiss., Fl. Orient. 1: 394 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 123 (1932); Davis, Fl. Turkey 1: 266 (1965); Zohary, Fl. Palaest. 1: 311, t. 460 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 192 (1974); Meikle, Fl. Cypr. 1: 100–101 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 91 (1978).

Annual, hispid or glabrescent, 25–60 cm. Stems erect, branched, distinctly furrowed, often stained purple. Radicle leaves large, petiolate, pinnatifid or pinnatisect to lyrate. Upper leaves sessile, usually undivided. Flowering racemes dense. Pedicels 2–4 mm long; lengthening and thickening in fruit. Fruit yellow. Sepals 4–5 mm long, petals 6–12 mm long, clawed. Stamens 6, about 5 mm long. Silique ascending 2·55–4 cm long (including beak), 0·2–0·3 cm wide, on a short, 3–7 mm thick, erect or spreading pedicel; cylindrical, glabrous or hispid; beak conical, tapering, straight 1–2 cm long, usually containing a single seed. Seeds globose, 1·5 mm in diameter, dark-brown.

Occasional in Qatar, in cultivated localities and lawns in Doha. Flowering from February to May.

11. *SISYMBRIUM* L.

Annual, biennial or perennial, glabrous or pubescent herbs. Stems erect. Leaves mostly lyrate-cleft. Racemes many-flowered, generally ebracteate; flowers rather small, petals generally yellow, sometimes white or pink, more or less clawed. Siliquas linear, elongate, dehiscent; valves generally 3-nerved. Seeds normally in one rank in each loculus, small, yellowish-brown; cotyledons conduplicate.

I. Fruiting pedicel as thick as fruit.
  1. Fruit conical, 2·5–4 cm long . . . 1. *S. erysimoides*
  2. Fruit linear, 8–10 cm long . . . 3. *S. orientale*
II. Fruiting pedicel thin . . . . . 2. *S. irio*

1. *Sisymbrium erysimoides* *Desf.*, Fl. Atl. 2: 84 (1798); Boiss., Fl. Orient. 1: 217 (1867); Zohary, Fl. Palaest. 1: 255 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 172 (1978).
Pachypodium erysimoides (Desf.) Webb. et Berth., Phyt. Canar. 1: 203 (1840).

Annual, pilose or glabrous, 15–60 cm. Stems erect, terete, somewhat flexous, sparingly branched. Radicle leaves up to 12 cm, petiolate, lyrate–pinnatisect; cauline leaves short-petioled, lyrate–pinnatifid. Racemes ebracteate, dense. Flowers minute, short-pedicelled. Sepals about 2 mm, erect, oblong, obtuse. Petals yellow, as long as or slightly longer than sepals, spathulate. Fruiting racemes elongated; pedicel 2–4 mm long, as thick as fruit. Fruit 2·5–4 cm, horizontal or spreading, stiff, terete, more or less glabrous, tapering gradually into the short style and terminating with a slightly 2-lobed stigma; valves submembranous, 3-nerved, septum membranous. Seeds 15–25 in each locule, oblong, orange-yellow.

Fairly common in the shade of *Ziziphus* bushes in the *rodat* in northern and central Qatar. Flowering from January to May.

2. ***Sisymbrium irio*** *L.*, Sp. Plant., ed. 1: 659 (1753); Boiss., Fl. Orient. 1: 217 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 711 (1932); Davis, Fl. Turkey 1: 485 (1965); Zohary, Fl. Palaest. 1: 253, t. 366 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 172 (1974); Jafri, Fl. Lib. 23: 176 (1977); Meikle, Fl. Cypr. 1: 165 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 91 (1972). *S. irioides* Boiss., in Ann. Sci. Nat. Bot. Ser. 2, 17: 76 (1842).

An erect, much branched annual, 20–45 cm, glabrous or sparsely hairy. Basal and lower leaves petiolate, petiole flattened, 2–3 cm long; upper leaves shortly petiolate. Inflorescence ebracteate, at first densely corymbose, later forming a rather lax raceme, the inconspicuous flowers soon overtopped by the developing fruits; pedicels filiform, 3–6 mm long, lengthening considerably in fruit. Sepals 2–3 mm, oblong, blunt. Petals yellow, 3–4 mm long, narrowly spathulate. Stamens subequal with yellow anthers. Siliquae erectopatent or incurved, terete, glabrous, 3–6 × 0·1 cm; septum white, membranous, style inconspicuous. Seeds 20–40 in each locule, 1 mm, yellowish-brown.
Weed in cultivated and waste ground. Flowering from February to May.

3. ***Sisymbrium orientale*** *L.*, Cent. Plant. 2: 24 (1756); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 69 (1932); Davis, Fl. Turkey 1: 484 (1968); Zohary, Fl. Palaest. 1: 254, t. 369 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 174 (1974); Jafri, Fl. Lib. 23: 178 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 91 (1978).
S. columnae Jacq., Fl. Austr. 4: 12, t. 323 (1776); Boiss., Fl. Orient. 1: 216 (1867).

An erect, rather sparsely branched annual, 25–90 cm. Stems often tinged purple, clothed (like the leaves) with soft spreading hairs. Lower leaves forming a loose rosette, distinctly petiolate, pinnatisect to lyrate, terminal lobe deltoid and toothed. Petioles channelled, 2–4 cm long. Upper leaves smaller, more shortly petiolate, terminal lobe sagittate or hastate, with 2 spreading or deflexed lateral lobes. Inflorescence ebracteate, at first corymbose, later forming a lax raceme, the flowers soon overtopped by the developing fruit. Pedicels slender 2–5 mm long, thickened, spreading in fruit. Sepals 4–5 mm. Petals 0·8–1 cm, yellow or whitish-yellow (by age), abruptly clawed. Stamens unequal, anthers yellow. Ovary sessile, narrowly cylindrical, 4 mm long, with short style. Siliquae erecto-patent, straight or slightly curved, subterete or obscurely 4-angled, 6–10 cm long, 1·5–2 mm wide, glabrous or very sparsely hairy. Seeds 40–50 in each locule, *ca.* 1 mm long, oblong, orange-brown.
Rare weed in lawns at Doha. Flowering from March to May (Plate 37).

12. *ZILLA FORSSK.*

Spiny desert, almost leafless shrubs. Stems more or less dichotomously branched. Leaves few, glabrous. Flowers pink or whitish. Fruit a globose silicle, indehiscent, with a long spinescent beak.

1. ***Zilla spinosa*** *(Turra) Prantl.* in Engl. et Prantl., Natürl. Pflanzenfam. 3, 2: 174, f. 112 (1891); Burtt et Lewis, Kew Bull. 4: 299 (1949), Zohary, Fl. Palaest. 1: 324, t. 474 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 197 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 62 (1978).

Z. myagroides Forssk., Fl. Aegypt.-Arab. 121, n. 74, 75 (1775); Boiss., Fl. Orient. 1: 408 (1867).

Bunias spinosa Turra. Farset. nov. gen. animadv. 11 (1765); Linn., Mant. 96 (1767).

A small desert shrub, densely branched with spine-tipped branches. Leaves more or less fleshy, soon deciduous. Racemes few-flowered. Flowers short-pedicelled, violaceous or lilac. Calyx 4–7 mm. Petals 0·6–2 cm. Fruit on a thick pedicel, globular, 6-ribbed with transverse wrinkles between ribs, tapering into a conical, spiny beak.

Rare in Qatar, recorded mainly in southern Qatar in sandy habitats. Flowering from March to May (Plate 37).

15. *RESEDACEAE* S. F. GRAY

Annual or perennial herbs or shrubs. Leaves spirally arranged, simply or variously lobed or divided. Stipules small, glandular. Inflorescence racemose or spicate, bracteate. Flowers zygomorphic. Sepals 4–7; petals 0–8, often unequal, frequently lobed or lacinate. Stamens 3-numerous; ovary of 2–6 free or united carpels. Gynoecium and androecium placed on a short androgynophore, which is expanded on one side into a prominent disc. Fruit a capsule, sometimes fleshy and berry-like.

1. Shrubs with linear, deciduous leaves; fruit a berry . . . . . 1. *Ochradenus*
2. Annual or perennial herbs, fruit a capsule . . . .
   a. Leaves narrowly linear, entire; petals 2, fruit sessile . . . 2. *Oligomeris*
   b. Leaves mostly divided, petals 4–8; fruit pedicelled . . . . 3. *Reseda*

1. *OCHRADENUS* DEL.

Much branching shrub; glabrous, often spinescent. Leaves simple, soon deciduous. Flowers minute, unisexual (plants polygamous or dioecious) or hermaphrodite, in terminal bracteate racemes. Sepals 5–6; petals absent; disc dilated unilaterally. Stamens 10–15. Ovary sessile 3-carpelled, placentation parietal, ovules pendulous. Capsule closed, dry and membranous or fleshy. (See additions p. 205).

1. *Ochradenus baccatus* *Del.*, Fl. Egypte 92, t. 31 (1813); Muell., Monogr. Res. 94 (1857); Boiss., Fl. Orient. 1: 422 (1867); Zohary, Fl. Palaest. 1: 330, t. 481 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 206 (1974); Migahid. Fl. Saudi Arab., ed. 2, 1: 92 (1978); Belmontia, N.S. Abdallah et De Wit, 8: 54 (1978).

Yellow-green shrub with thick, stout, spinescent branches. Leaves soon deciduous, frequently fasiculate, narrowly linear. Flowers in rigid spike-like racemes. Flowers mostly unisexual, short-pedicelled. Petals absent. Stamens 12–18. Fruit a berry, 4–6 mm ovoid, with rounded apex, glabrous, green, becoming waxy white when ripe.

The plant is common in Qatar in *rodat* supporting *Ziziphus nummularia*. *Ochradenus* grows protected by the dense growth of *Ziziphus*. Flowering from March to May (Plate 38).

2. *OLIGOMERIS* CAMBESS

Annual or perennial herbs. Leaves entire, scattered or fasciculate. Flowers minute; calyx

persistent; petals 2, white. Floral disc absent. Ovary sessile, 3–5 carpelled; placentation parietal, ovules pendulous, numerous. Capsule deeply furrowed.

1. ***Oligomeris subulata*** *(Del.) Boiss.*, Fl. Orient. 1: 435 (1867); Zohary, Fl. Palaest. 1: 330, t. 482 (1966). *Reseda subulata* Del., Fl. Aegypt. Ill. 15 (1813). *Oligomeris linifolia* (Vahl ex Hornem.) Macbride, Contr. Grey Herb Ser. 2, 53: 13 (1918); Rech., Fl. Lowland Iraq 324 (1964). *Resede linifolia* Vahl in Hornem., Hort. Hafn. 2: 501 (1815).

Annual or biennial, glabrous, 10–40 cm. leaves 2–7 × 0·1–0·3 cm, fasciculate, simple, narrowly linear to almost subulate. Racemes spike-like. Bracts 1–2 mm, persistent. Flowers 1–2 mm, almost sessile. Sepals 2–5, persistent. Petals white, longer than sepals. Stamens 3. Fruiting racemes elongated, rather loose. Capsule 3–4 mm, sessile 4-carpelled, 4-dentate.

Common in depressions. Flowering from March to May (Plate 39).

3. *RESEDA* L.

Annual or perennial herbs with frutescent base. Leaves pinnately lobed or divided. Inflorescence spike-like raceme. Flowers white, yellow or yellowish-green. Sepals 4–5; petals 4–8. Stamens 10–40 inserted upon a floral disc inside perianth. Ovary often short stipitate. Capsule 3–4 toothed with gaping mouth.

1. Annuals, stems sparingly pruinose, sepals persistent; fruit pendulous . 1. *R. arabica*
2. Biennials or perennials, sepals deciduous, fruit erect . . . . 2. *R. muricata*

1. ***Reseda arabica*** *Boiss.*, Diagn. Ser. 1, 1: 6 (1843) et Fl. Orient. 1: 426 (1867); Müll., Monogr. Res. 124 (1827); Rech., Fl. Lowland Iraq 326 (1964); Zohary, Fl. Palaest. 1: 333, t. 485 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 210 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 101 (1978); Abdallah et De Wit, *l.c.* 8: 158 (1978).

Annual, sparingly pruinose, 8–40 cm. Stems erect, often branching from base. Leaves tapering at base, the lowest entire, oblong–lanceolate, the upper ternate with linear to oblanceolate lobes of which the middle one is larger than the lateral. Flowering racemes spike-like, rather loose. Bracts 2–3 mm, persistent. Pedicels longer than calyx. Flowers 2–3 mm, white calyx persistent with 6 oblong sepals. Petals 6, somewhat shorter than sepals. Stamens about 20 with persistent filaments. Ovary sessile. Capsule 0·6–1 cm, pendulous, globular ellipsoidal, 3-toothed.

Rare in Qatar. Flowering from March to April.

2. ***Reseda muricata*** *C. Presl.*, Bot. Bemerk. 8 (1844); Müll, Monogr. Res. 159 (1857); Boiss., Fl. Orient. 1: 431 (1867); Zohary, Fl. Palaest. 1: 336, t. 491 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 210 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 92 (1978); Abdallah et De Wit, *l.c.* 8: 280 (1978).

Perennial, scabrous–pruinose herbs, woody at base, 10–50 cm. Stems erect, rigid, almost simple or branching from lower parts. Lower leaves linear–lanceolate, entire, others ternately or 2-ternately divided with linear lobes. Racemes dense. Bracts 2·5–4 mm, deciduous. Pedicels shorter than calyx. Flowers 3–4 mm, white. Calyx (6 sepals) shorter than corolla. Stamens 14–17 with persistent filaments. Fruiting pedicels usually shorter than capsule. Capsule 6–8 mm, erect, obovoid, 3-denticulate apex.

This species is more common in Qatar than the above one. Flowering from March to April (Plate 39).

16. *NEURADACEAE J. E. AGARDH*

Prostrate, tomentose or woolly herbs with alternate, variously lobed or pinnatifid leaves; stipules minute or absent. Flowers regular, hermaphrodite, solitary, axillary, small to showy, sometimes with epicalyx of 5 bracteoles.

Sometimes as a subfamily of *Rosaceae*, but differs mainly in its peculiar hard discoid spinose fruits, in which the seeds are retained in germination. The older spiny disc-shaped hypanthium in *Neurada* (often called fruit coat) persists as a collar around the base of the new plant.

1. *NEURADA L.*

Annual herb with prostrate, unarmed stems. Leaves alternate, lobed. Flowers axillary, solitary, pedicellate; receptacle discoid, flattened, echinate, persistent in fruit. Fruit woody, 1-valved.

1. ***Neurada procumbens** L.*, Sp. Plant., ed. 1, 441 (1753); Fl. Orient. 2: 735 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 467 (1932); Meikle in Guest, Fl. Iraq 2: 151 (1966); Zohary, Fl. Palaest. 2: 25 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 219 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 292 (1978).

A prostrate, densely tomentose annual herb, with numerous branches radiating from the rootstock. Leaves alternate, 0·8–2·5 cm long, 0·5–2 cm wide, ovate–oblong, obtusely sinuate pinnatifid, bistipulate, petiole about 1 cm long. Flowers 0·5–1 cm diameter, solitary, axillary, pedicellate. Epicalyx consisting of 5 subulate bracteoles, turning into prickles. Calyx 5-fid; lobes ovate to lanceolate. Petals whitish-yellow or pink, obovate, *ca.* 1·5 × 1 mm. Stamens 10, 2 mm long. Carpels 10, partly united, each 1-ovuled; style exerted, spiny. Fruit 10–20 mm across, depressed, orbicular, echinate above, smooth below, indehiscent, spiny, woolly. The fruit does not break up on germination of the seeds, but remain attached as a collar around the rootstocks of young and mature plants.

Sandy habitats: the plant is common in southern Qatar and easily identified by its spiny orbicular fruits. Flowering from February to April. The plant is grazed by sheep, goats and camels. Local name: *Sa'dan* ('of prosperous augury'). This name is used for the plant, not only in Qatar, but also throughout the Arab World (Plate 40).

17. *LEGUMINOSAE A. JUSS.*

Trees, shrubs, lianes or herbs. leaves alternate or more rarely opposite, commonly bipinnate, pinnate or trifoliate, rarely simple; stipules rarely absent, sometimes modified into spines; stipels present or absent. Flowers mostly bisexual, actinomorphic in *Mimosoideae* but very rarely so in *Caesalpinoideae* and *Papillionoideae*; sepals usually more or less fused; petals free, connate into a lobed corolla, or the two abaxial fused along

the lower margin. Stamens hypogynous, free or more or less monadelphous. Ovary unicarpellate, superior, placentation parietal along the ventral suture with ovules in two alternating rows.

This diverse but very natural unit has been treated by Bentham and Hooker (1862–83) and Engler and Prantl (1887–99) as a single family (the *Leguminosae*), but divided into three separate families (*Mimosaceae, Caesalpiniaceae, Papillionaceae*) under Hutchinson's system.

I. Flowers regular, very small, in heads. Shrubs or trees, with stipular spines, bipinnate leaves . . . . 1. *Acacia*
II. Flowers irregular, large, not papillionaceous. Leaves pinnate; fruit flattened . . . . 4. *Cassia*
III. Flowers irregular, papillionaceous, with standard, keel and wings.
  A. Leaves simple.
    a. Spiny shrublets . . . . 2. *Alhagi*
    b. Unarmed plants.
      + Leaves serrate, glandular hairy . . . . 12. *Ononis*
      ++ Leaves entire.
        o. Herbs, leaves large, oblong–lanceolate, flowers yellow . . . . 15. *Scorpiurus*
        oo. Shrublets, leaves small, flowers pink or purple . 16. *Taverniera*
  B. Leaves 3-foliate.
    a. Terminal leaflet supported by small stipules . . . . . 14. *Rhynchosia*
    b. Leaflets not stipuled.
      + Leaflets dentate or serrate.
        o. Withered corolla persistent, hiding the small legume; flowers in heads . . . . 17. *Trifolium*
        oo. Corolla deciduous, legumes exposed.
          1. Legume spirally twisted, often spiny . . 10. *Medicago*
          2. Legume small rounded, 1-seeded; flowers yellow or white, racemed . . . . . . 11. *Melilotus*
          3. Legume oblong; flowers pink, plants glandular hairy . . . . 12. *Ononis*
          4. Legume linear, mostly curved and compressed; flowers yellow . . . . . 18. *Trigonella*
      ++ Leaflets repand–undulate, gland-dotted . . . . 13. *Psoralea*
      +++ Leaflets entire.
        o. Stipulates as large as the leaflets; legume linear 9. *Lotus*
        oo. Not so; legume oblong . . . . 8. *Lotononis*
  C. Leaves imparipinnate ending in a tendril . . . . . . 19. *Vicia*
  D. Leaves imparipinnate with a spinescent rachis . . . . . 3. *Astragalus sieberi*
  E. Leaves imparipinnate, 2 or more paired terminated by a leaflet.
    a. Leaflets 3–7 with the terminal largest; pod reniform strongly compressed . . . . 6. *Hymenocarpos*
    b. Leaflets 5–9 close, sessile, almost equal; pod silvery with transverse walls between the seeds . . . . 7. *Indigofera*
    c. Not so.
      + Legume ribbon-like with numerous circular cuts along 1 margin . . . . 5. *Hippocrepis*
      ++ Legume otherwise . . . . 3. *Astragalus*

1. *ACACIA* MILL.

Spiny (sometimes unarmed) shrubs or trees. Leaves bipinnate or (not in species native to the Orient) modified to phyllodes. Stipules spinescent or not. Flowers small, regular, with numerous stamens, aranged in spikes or heads. Pod very variable in form.

Acacia, from the Greek *akakia*, a name in Dioscorides meaning a point or thorn (Townsend, Fl. Iraq 3: 44 (1974)).

Two species of *Acacia* are growing wild in Qatar; however, perhaps more than 3 species were introduced and cultivated as hedges in streets or in reafforestation programmes carried out by the Ministry of Industry and Agriculture.

1. Branches, leaves and legumes glabrous, pinnate 1–2 pairs . . 1. *A. ehrenbergiana.*
2. Branches, leaves and legumes pubescent, pinnae (4–) 5 (–8) pairs 2. *A. tortilis.*

1. *Acacia ehrenbergiana* *Hayne*, Darst. Beschr. Arzneik. Gewachse 10: t. 29 (1827); Täckh., Stud. Fl. Egypt, ed. 2, 291 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 299 (1978). *A. flava* Schweinf., Bull. Herb. Boiss. App. II: 214 (1896).

A spiny shrub, not exceeding 3 m. Branches, leaves and legumes glabrous. Stipular spines 2–3 cm long, white, leaves bipinnate; pinnae 1–2 pairs; oblong, obtuse, glabrous. Flowers in heads, yellow. Legume falcate, constricted between the seeds.

A common shrub in Qatar. It grows in depressions and wadis receiving runoff water and fine waterborne sediments. Flowering from April to May. Local name: *Salam* (Plates 41, 42).

2. *Acacia tortilis* *(Forssk.) Hayne*, Darst. Beschr. Arzneik. Gewachse 10: t. 31 (1827); Zohary, Fl. Palaest. 2: 28, t. 41 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 289 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 299 (1978).

Mimosa tortilis Forssk., Fl. Aegypt.-Arab. 176 (1775). *Acacia tortilis* (Forssk.) Hayne ssp. *tortilis* Brenan, Kew Bull. 1975: 86 (1957). *A. spirocarpa* Hochst. ex A. Rich. var. *minor* Schweinf., Linnaea 35: 323 (1867–68); Boiss., Fl. Orient. 2: 636 (1872) *pro syn.*

A shrub or a small tree, reaching 6–8 m in height, branching from base, umbrella-shaped with flat-topped crown. Young branches reddish, pubescent. Stipules partly long white straight, partly small recurved dark-tipped. Pinnae (4–) 5 (–8) pairs, with a small gland under each pair, leaflets (4–) 10 (–12) linear, obtuse, pubescent. Heads one or more in each axil, 4–7 mm across, pale-yellow to whitish. Pod 3–9 × 0·5–0·6 cm, leathery, yellow-brown, twisted in 1–3 coils, pubescent.

A very common shrub in Qatar. It dominates a community abounding in the southern depressions in the country. The plant exhibits stunted growth on the *hozoom* (slightly elevated land surrounding the depressions). Local name: *Samr*. Flowering from May to June (Plates 41, 43).

2. *ALHAGI* ADANS.

Spiny shrublets. Branches spinescent, bearing leaves and flowers. Leaves simple, entire, soon deciduous. Flowers solitary, purple. Legume swollen, indehiscent, constricted between the seeds.

1. *Alhagi maurorum* *Medik.*, Vorles. Churpf. Phys.-Oken. Ges. 2: 397 (1787); Zohary, Fl. Palaest. 2: 112, t. 165 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 272 (1974); Meikle, Fl. Cypr. 1: 534 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 314, t. 324 (1978).
Hedysarum alhagi L., Sp. Plant., ed. 1, 745 (1753).

Shrubby, rich-branched perennial, with erect to ascending spinescent twigs. Leaves 1–2 cm long, entire, simple. Inflorescence 3–8 flowered in a lax raceme. Flowers on spiny twigs, rose to reddish. Pod conspicuously moniliform 2–3 cm long, usually 3–6 seeded.

It has been recorded in Qatar in three localities: Al-Magda farm, Abu Samrah farm and the littoral salines at Umm Bab. It is a noxious weed on deep alluvial soil and tolerates saline and wet conditions. The plant is eaten by camels, hence the English name 'Camel Thorn'; known in folk medicine as a remedy for a variety of diseases.

Local name: *A'qool (Agul)*, a name used for the same species in other Arab countries.

3. *ASTRAGALUS* L.

Annual, biennial and perennial herbs and subshrubs; leaves stipulate, imparipinnate or paripinnate, sometimes with the rachis produced into a hard terminal spine. Flowers in axillary racemes, lax and few-flowered or dense axillary pedunculate terminal heads, dense axillary clusters forming a close compound inflorescence.

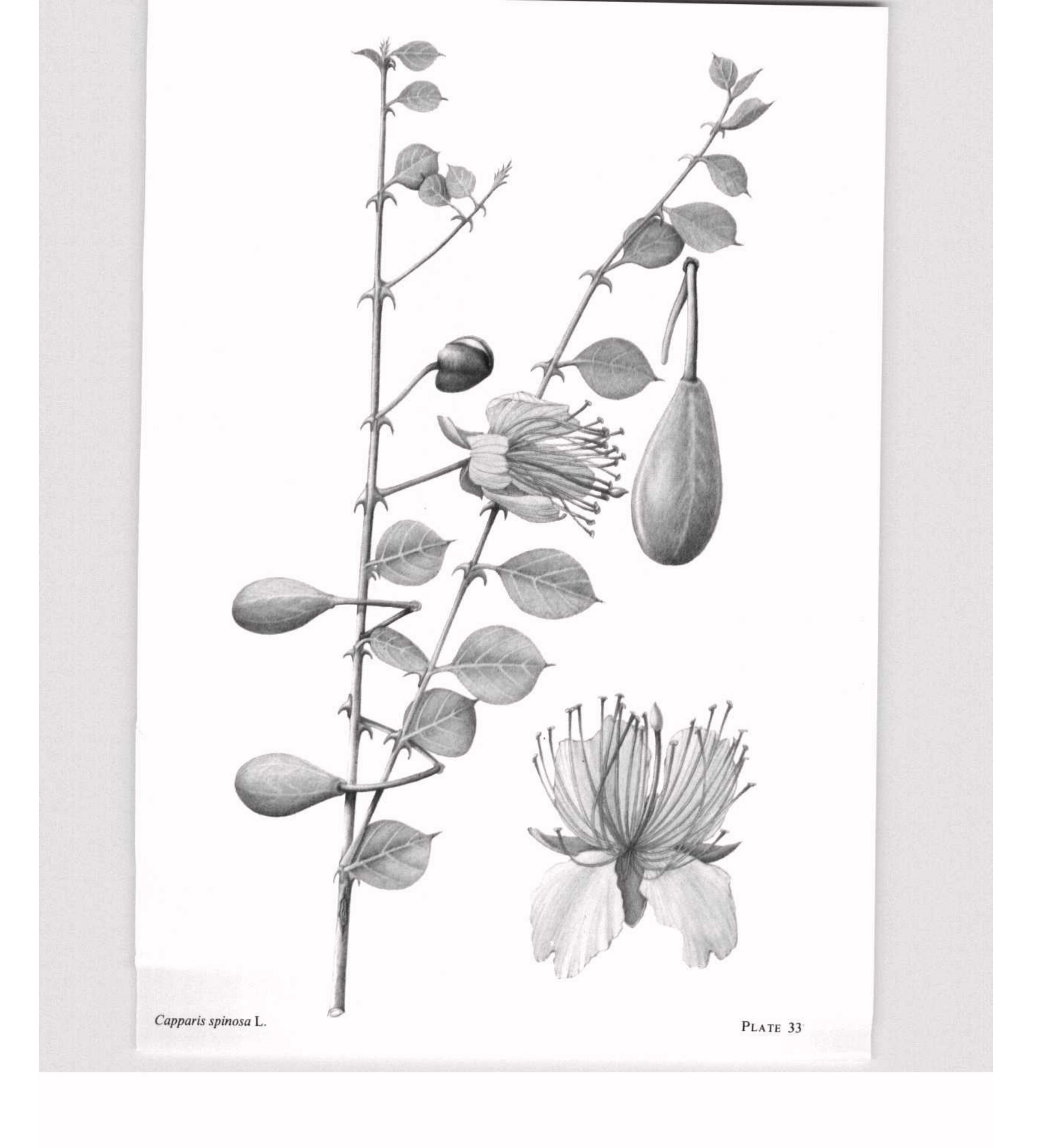
+ Spiny undershrubs; spines consisting of persistent, indurated leaf petioles	6. *A. sieberi*
+ + Annual herbs.	
A. Flowers capitate (umbelled).	
1. Pods villous 15–20 × 3–4 mm	5. *A. schimperi*
2. Pods adpressed hairy 5–12 × 1·5–4 mm	7. *A. tribuloides*
B. Flowers racemed.	
1. Pods villous	3. *A. eremophilus*
2. Pods adpressed hairy or glabrous.	
a. Pods red-spotted	1. *A. annularis*
b. Pods without spots	
o. Pod wrinkled glabrous	2. *A. corrugatus*
oo. Pod smooth	4. *A. hamosus*

1. *Astragalus annularis* *Forssk.*, Fl. Aegypt.-Arab. 139 (1775); Vahl, Symb. Bot. 1: 58 (1790); DC., Astrag. 251, t. 7 (1802); Boiss., Fl. Orient. 2: 236 (1872); Post, Fl. Syn., Pal. et Sinai, ed. 2, 1: 380 (1932); Eig, Syst. Stud. Astrag. Near East 23 (1955); Zohary, Fl. Palaest. 2: 64, t. 84 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 265 (1974); Towns., Fl. Iraq 3: 275 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 340 (1978).

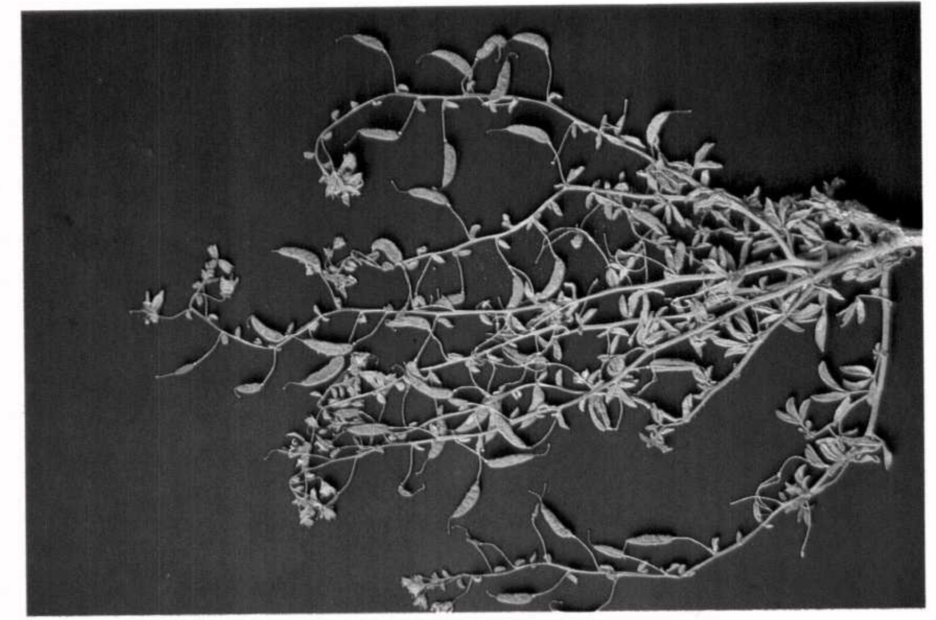
A prostrate annual with greyish hairs. Leaflets 2–4 pairs, ovate to oblong, 5–17 × 2–4 mm, hairy on either side. Peduncles as long as subtending leaves. Racemes 2–5-flowered. Bracts longer than pedicels. Flowers 6–8 mm; calyx campanulate, black and white hairy, teeth almost as long as tube. Corolla pink to pale-purple. Pod 30–50 × 2·5–4 mm, horseshoe-shaped, adpressed hairy, glabrescent at maturity, mottled with red spots. Beak short, hooked.

Rare in Qatar. It grows in sandy depressions. Flowering from March to April.

2. *Astragalus corrugatus* *Bertol.*, Rar. Ital. Pl. Dec. 3: 33, no. 1 (1810); et Amoen. Ital. 38



Capparis spinosa L.

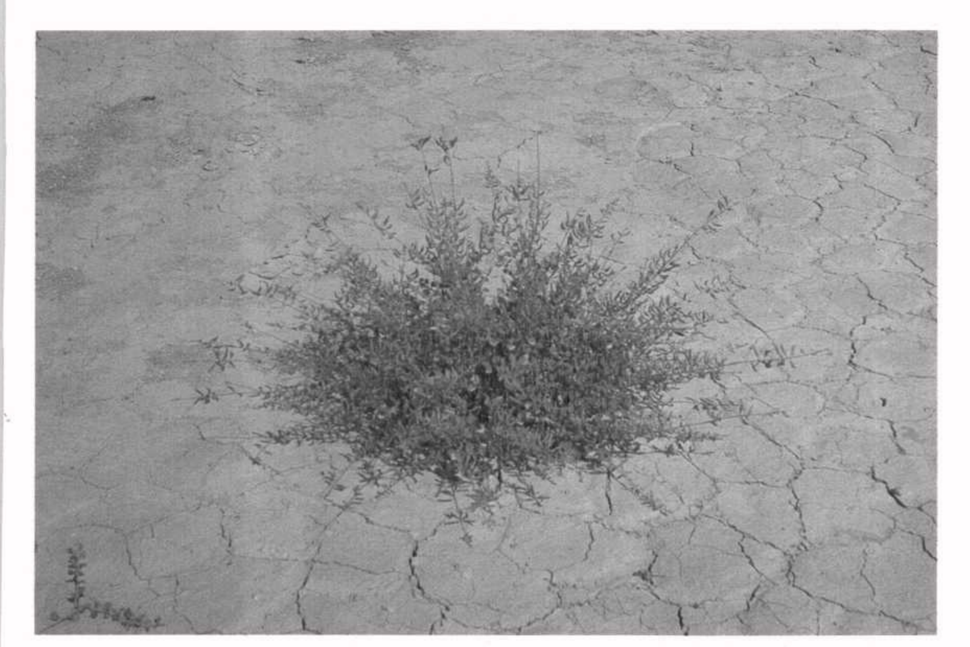


Cleome brachycarpa Vahl ex DC.



Cleome brachycarpa Vahl ex DC.

PLATE 34



Cleome scaposa DC.



Cleome scaposa DC.



Anastatica hierochuntica L.



Anastatica hierochuntica L.
Dry fruiting plant.

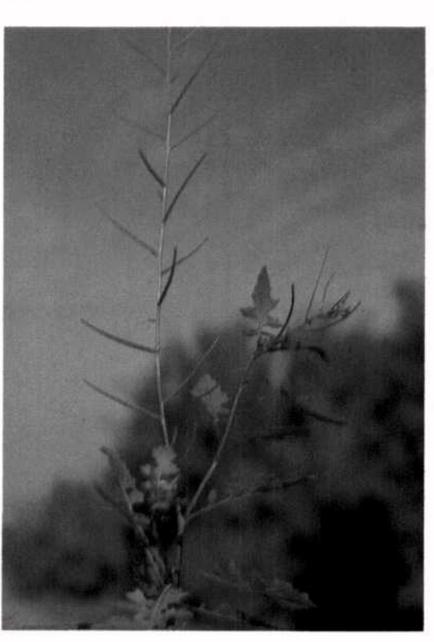
PLATE 36



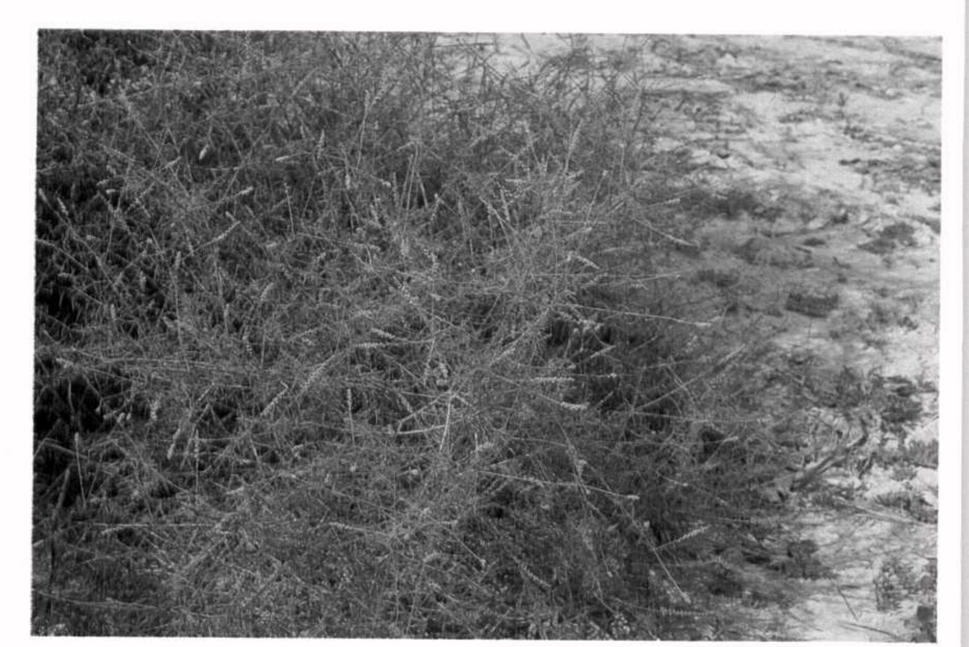
Erucaria crassifolia (Forssk.) Del.



Savygnia parviflora (Del.) Webb.



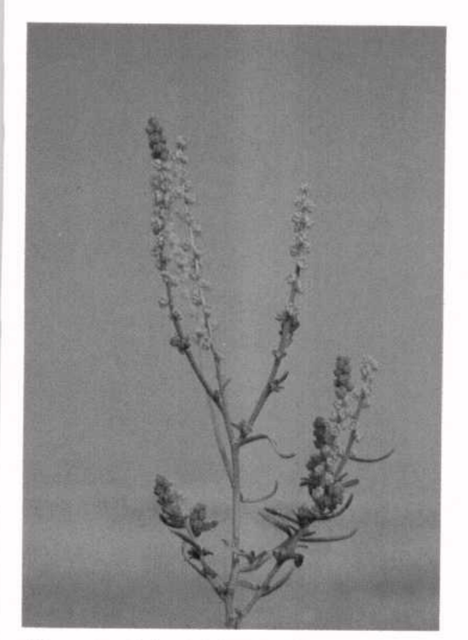
Sisymbrium orientale L.



Ochradenus baccatus Del.



Ochradenus baccatus Del.



Oligomeris subulata (Del.) Boiss.



Reseda muricata C. Presl.



Reseda muricata C. Presl.



Cocculus pendulus (J. R. et G. Forst.) Diels.



Neurada procumbens L.

(1819); Boiss., Fl. Orient. 2: 232 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 378 (1932); Eig, Syst. Stud. Astrag. Near East 16 (1955); Zohary, Fl. Palaest. 2: 61, t. 77 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 264 (1974); Towns., Fl. Iraq 3: 266, t. 39 (1974).

Annual, sparingly adpressed hairy, branching from base; 6–30 cm; stems decumbent or ascending. Leaflets 5–8 pairs, linear to oblong, 5–12 × 1–3·5 mm, sharply notched at apex. Inflorescence 1–7 subsessile flowers in short lax racemes. Peduncles equalling the leaves. Corolla pink, or purple to yellow or creamy white. Pod 3–4 × 0·2–0·3 cm, erect, almost cylindrical, semicircular, not wrinkled all along; dorsal suture convex.

Occasional in Qatar. It grows on fine shallow soils. Flowering from February to March (Plate 44).

3. *Astragalus eremophilus* *Boiss.*, Diagn. Ser. 1, 2: 54 (1843); Täckh., Stud. Fl. Egypt, ed. 2, 264 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 341 (1978).

Prostrate or procumbent annual herbs. Stems grey silky, tomentose. Leaflets in few (3–6) pairs, obovate, obtuse at the apex, up to 5 mm long, grey silky canescent. Flowers small pale sulphur yellow, in 2–4-flowered lax axillary racemes. Pod linear, strongly curved, swollen, about 3 mm broad, 2·5 cm long, grey silky tomentose, partly divided inside by a longitudinal membrane.

Rare in Qatar, occurring in depressions in southern Qatar. Flowering from February to April (Plate 44).

4. *Astragalus hamosus* *L.*, Sp. Plant., ed. 1, 758 (1753); Boiss., Fl. Orient. 2: 238 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 381 (1932); Zohary, Fl. Palaest. 2: 66, t. 87 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 265 (1974); Towns., Fl. Iraq 3: 414, t. 75 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 340 (1978).

Annual, appressed–pubescent herb. Leaves 4–15 cm, leaflets in 7–12 pairs, ovate to oblong, retuse, glabrous above, appressed hairy beneath. Peducles shorter than subtending leaves. Inflorescence a capitate raceme, up to 10-flowered. Flowers yellowish-white; calyx teeth subulate, longer than tube. Pod sessile, deflexed, semicylindrical, fish hook-shaped with tip slightly curved outwards.

The plant is rare in Qatar. It has been collected only in Al-Wabrah. Flowering in February; fruiting from March to May (Plate 45).

5. *Astragalus schimperi* *Boiss.*, Diagn. Ser. 1, 2: 53 (1843); Boiss., Fl. Orient. 2: 226 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 378 (1932); Eig, Syst. Stud. Astrag. Near East 13 (1955); Zohary, Fl. Palaest. 2: 60, t. 76 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 264 (1974); Towns., Fl. Iraq 3: 258, t. 37 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 340 (1978).

Annual, branched from the base, appressed hairy or villous. Leaflets in 4–8 pairs, 4–8 × 1·5–2·5 mm, petiolate, hairy on both sides. Peduncles often longer than leaves. Heads 4–8-flowered; flowers 1–1·5 cm, subsessile. Calyx tubular, hairy; teeth one-third or one-half as long as tube. Corolla bluish-white or violet. Pods 1·5–2·5 × 0·25–0·4 cm, stellately spreading or erect in umbellate heads, nearly terete, linear to oblong, curved, furnished with both long-patulous hairs with tuberculate base, and short, appressed hairs; beak short, recurved.

Rare in Qatar; it grows in *rodat*, especially in central Qatar. Specimens were collected from Al-Wabrah. Flowering from March to May.

6. ***Astragalus sieberi*** *DC.*, Prodr. 2: 295 (1825); Boiss., Fl. Orient. 2: 301 (1872); Zohary, Fl. Palaest. 2: 75, t. 105 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 268 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 341 (1978).

Dwarf spiny shrub, branching from base. Stems and branches white woolly. Leaves with 20–25 pairs of leaflets on elogated later frutescent spiny petioles; leaflets ovate or orbicular, white hairy. Racemes few-flowered, crowded at base of short branches. Flowers about 2·5 cm short-pedicelled. Calyx tube one-fifth or one-quarter as long as tube. Corolla yellow. Pod 3–4 cm long, 0·5–0·8 cm wide, woody, triquetrous, straight or slightly curved.

It is rare in Qatar and grows in wadis, e.g. Wadi Dhiab. Flowering from February to April (Plate 45).

7. ***Astragalus tribuloides*** *Del.*, Fl. Aegypt. Ill. 70 (1813); Boiss., Fl. Orient. 2: 224 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 376 (1932); Eig, Syst. Stud. Astrag. Near East 6 (1955); Zohary, Fl. Palaest. 2: 58, t. 73 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 263 (1974); Towns., Fl. Iraq 3: 252, t. 37 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 340 (1978).

Small silvery hairy annual herb with numerous prostrate stems. Leaflets in 6–10 pairs, oblong, lanceolate or almost linear. Heads sessile or subsessile in the leaf axils, 6–10 flowered; flowers 0·5–1·5 cm long, white to creamy, purple-flushed or purple. Pods stellately divergent, 5–12 mm long, oblong–triangular, slightly curved, with acute tip and auricled base, adpressed hairy.

In Qatar *A. tribuloides* Del. var. *minutus* (Boiss.) Boiss. is more common than the type.

Var. ***minutus*** (Boiss.) Boiss., Fl. Orient. 2: 225 (1872); Post, l.c.; Eig, l.c.,; Zohary, l.c.; Täckh., l.c.; Towns., l.c.

A. minutus Boiss., Diagn. Ser. 1, 9: 58 (1849).

Pod hairy, somewhat longer than calyx, usually less than 7 mm long; ovules mostly 6–10.

The variety is common in Qatar, particularly in depressions. Flowering from February to March (Plate 46).

4. *CASSIA* L.

Herbs, shrubs or trees, with paripinnate leaves and yellow racemed flowers. Corolla of 5 free usually yellow petals, the upper smallest and the lower largest. Pods variable.

Cassia, from the Greek name for the plant *kassia* in Dioscorides.

1. ***Cassia italica*** *(Mill.) Lam. ex. Steud.*, Nomen. ed. 1, 167 (1821); Andrews, Flow. Plant. Anglo-Egypt. Sud. 2: 117, f. 49 (1952) Zohary, Fl. Palaest. 2: 33, t. 46 (1972), Täckh., Stud. Fl. Egypt, ed. 2: 284 (1974); Towns., Fl. Iraq 3: 14 (1974); Singh, Jouvn. Bombay Nat. Hist. Soc. 75, 2: 435 (1978).

Senna italica Mill., Gard. Dict. ed. 8, no. 2 (1968). *Cassia aschrek* Forssk., Fl. Aegypt.-Arab. 86 (1775). *Cassia senna* Burm. f., Fl. Ind., t. 33, F. 2 (1968) non Linn. *C. obovata* Collad. Hist. Casses 92, t. 15A (1816); Boiss., Fl. Orient. 2: 631 (1872). Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 440 (1932).

Undershrub with soft branches from a woody base. Leaflets in 3–5 pairs, obovate to oblong, usually obliquely oblong. Racemes axilliary, many-flowered. Bracts oblong-ovate, *ca.* 5 mm, early caducous. Flowers 1·5–2 cm. Petals yellow striped with violet veins. Anthers unequal, the 2 anterior ones larger. Pod 4–6 × 1·5–2 cm, flat, broadly rounded at the extremities; valves coriaceous, with an undulate crest on each side along midrib.

The plant is fairly common in Qatar, perhaps not very common due to human interference and occasional cutting. It grows on rocky and gravelly habitats all over the country.

The plant is reputed for its medicinal value, it yields the official *folia* and *fructus sennae* used as a purgative and stimulant. The dried leaves and fruits are sold in the market for such purposes.

Local name: *Ishriq* or *Ishrig* (from which Forsskal clearly took the specific epithet aschrek, one of the synonyms of *C. italica*). This name is used throughout Arabia, also for other wild *Cassia* spp. Flowering over summer until autumn (Plate 47).

5. *HIPPOCREPIS* L.

Annual herbs (in Qatar). Leaves imparipinnate with entire leaflets. Flowers yellow, solitary or in 2–6 flowered umbellate inflorescence. Legume ribbon-like, straight or curved, the margin excavated opposite each seed; segments horseshoe-shaped, usually separating at maturity.

Hippocrepis, from the Greek *Hippos*, horse, *crepis*, shoe, a name suggested by the shape of the joints of the pod.

1. Flowers sessile, or nearly so, solitary or in pairs in the leaf axils. . . . 4. *H. unisiliquosa*
2. Flowers in peduncled umbels.
   a. Pod curved into 2 or more rings, each sinus of legume ending in 2 elongated divergent narrow horns . . . . 1. *H. bicontorata*
   b. Pod not curved into 2 or more rings; processes blunt and rounded.
      x. Flowers *ca.* 7 mm; leaflets in 4–7 pairs; pod lobed on outer (convex) surface. . . . . 3. *H. multisiliquosa*
      x. Flowers *ca.* 4·5 mm; leaflets in 2–3 pairs; pod lobed on inner (concave) surface . . . . 2. *H. constricta*

1. *Hippocrepis bicontorata* *Loisel*, Nouv. Not. 32 (1827) et Fl. Gall., ed. 2, 2: 162 (1828); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 366 (1932); Zohary, Fl. Palaest. 2: 105, t. 156 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 252 (1974); Towns., Fl. Iraq 3: 465, t. 91 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 339, t. 354 (1978).

Annual herb, erect or decumbent. Leaves imparipinnate with 3–5 pairs of leaflets, lower petioles 1–1·5 cm, upper shorter; leaflets linear, deeply emarginate at the apex. Inflorescence 2–5 flowered. Peduncles usually longer than subtending leaves. Corolla yellow. Pod coiled into 2 or more rings, the processes at the upper end of each horseshoe-shaped sinus elongate, linear; opening of the sinus facing the convex margin of the pod.

The plant is not common, it grows in sandy depressions. Local name: *Um Al-Garain* (mother of the 2 plaits) due to its horns on the fruit. It is palatable to sheep and goats. Flowering from March to May (Plate 47).

2. ***Hippocrepis constricta*** *Kunze*, Pugill. Pl. Prim. 42 (1838); Täckh., Stud. Fl. Egypt, ed. 2, 252 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 339, t. 355 (1978). *H. ciliata* (non willd.) Boiss., Fl. Orient. 2: 185 (1872).

Our species has characters similar to *H. constricta* Kunze, but not these of *H. ciliata* Willd. described from Iraq (Townsend, Fl. Iraq 3: 464 (1974)).

Annual small prostrate herb. Leaves imparipinnate with 2–3 pairs of elliptic obtuse leaflets. Flowers yellow, *ca.* 4·5 mm, in peduncled umbels; peduncles less than 2 cm long (in *H. ciliata* 2–6 cm). Petals yellow. Pod almost straight with the sinuses on the slightly concave margins. Pods separating into joints at maturity in contrast to the other species in which the pod is deciduous as a unit.

The plant grows on alluvial sandy deposits in the *rodat*. It is palatable to sheep and goats. Flowering from March to May (Plate 48).

3. ***Hippocrepis multisiliquosa*** *L.*, Sp. Plant, ed. 1, 744 (1753); Boiss., Fl. Orient. 2: 185 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 366 (1932); Davis, Fl. Turkey 3: 547 (1970); Zohary, Fl. Palaest. 2: 104, tt. 154, 155 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 252 (1974); Towns., Fl. Iraq 3: 463, t. 91 (1974); Meikle, Fl. Cypr., 1: 321 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 339, t. 352 (1978).

Annual herb. Leaves imparipinnate with 4–8 pairs of narrow oblong leaflets. Leaflets 5–16 (–20) mm long, 1·5–6 mm wide, glabrous or glabrescent. Petiolar glands present. Inflorescence 3–8-flowered, axillary, umbellate, pedunclate, peduncle 3–6 cm long; pedicels short, recurved. Petals yellow, 6–8 mm. Pods flattened, semicircular to circular, sinus almost completely closed, opening of sinus facing the convex margin of pod. Rare in Qatar (Plate 48).

4 ***Hippocrepis unisiliquosa*** *L.*, Sp. Plant., ed. 1, 744 (1753); Boiss., Fl. Orient. 2: 184 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 366 (1932); Davis, Fl. Turkey 3: 545 (1970); Zohary, Fl. Palaest. 2: 103, t. 153 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 252, t. 78 (1974); Towns., Fl. Iraq 3: 460 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 339, t. 353 (1978).

Annual, prostrate or suberect. Leaves imparipinnate with 3–7 pairs of leaflets, leaflets subsessile, linear–oblong to obovate, retuse and mucronulate at apex. Racemes subsessile in the axils of leaves; 1–2- (very rarely 4-) flowered. Flowers 4–7 mm, on very short pedicels. Corolla twice or as long as calyx, yellow. Pod 2–5·5 × 0·2–0·6 cm, erect or sometimes deflexed, compressed, linear of 4–12 flattened segments; sinus of each segment open or almost closed, opening of sinus facing the concave margin of pod.

Fairly common in Qatar, in depressions. Flowering from March to April.

6. *HYMENOCARPOS SAVI*

Annual herbs. Leaves (at least upper ones) 3–7-foliate, with the terminal leaflet largest. Flowers yellow, 2–4 together in peduncled axillary heads. Pod reniform, strongly compressed, indehiscent.

Hymenocarpos, from the Greek *humen*, membrane, envelope, *karpos*, fruit, alluding to the thin compressed pod.

1. ***Hymenocarpos circinnatus*** *(L.) Savi*, Fl. Pis. 2: 205 (1798); Boiss., Fl. Orient. 2: 159

(1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 352 (1932); Täckh., Stud. Fl. Egypt, ed. 2, 245 (1974); Towns., Fl. Iraq 3: 196 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 339 (1978).

Medicago circinnata L., Sp. Plant., ed. 1, 778 (1753).

Hymenocarpos nummularius (DC.) Boiss., Fl. Orient. 2: 160 (1872).

H. circinnatus (L.) Savi var. *nummularius* (DC.) Bornm., Beih. Bot. Centralbl. 57B: 258 (1937).

Annual herb, 6–20 cm high, much branched from the base, covered with shaggy spreading or loosely appressed hairs. Leaves imparipinnate, 3–7-foliate, the terminal leaflet largest reaching 6 cm long in lower leaves. Leaf margin entire. Inflorescence terminal and axillary, 2–4-flowered. Peduncles 1–3 cm, equalling or shorter than the subtending leaves. Corolla pale yellow, drying reddish somewhat exceeding the calyx teeth. Pod reniform, *ca.* 1–1·5 cm diameter, compressed, margin crenate, prickly.

Rare in Qatar; recorded at Doha. Flowering and fruiting from March to April.

7. *INDIGOFERA* L.

Annual herbs or undershrubs (our species), with simple or imparipinnate leaves of one or several pairs of leaflets. Flowers (in our species) flesh-coloured. Legume narrow, linear, flat or (in ours) terete, septate between the seeds.

1. ***Indigofera articulata*** *Gouan*, Illust. Obs. Bot. 49 (1773); Täckh., Stud. Fl. Egypt, ed. 2, 255 (1974).

I. glauca Lam. *I. tinctoria*, sensu Forssk., Fl. Aeg.-Arab. 138 (1775), non L., *I. argentea*, sensu Bak. and sensu L. p.p., non Burm. f.

Silvery undershrub. Leaflets 3–5, rarely 7 or 1, opposite, obtuse, silky hairy on both faces. Flowers small, flesh-coloured, in short axillary racemes not exceeding the leaves. Legume short, thick, tubercled-looking of 2–4 large globose seeds, dorsal and ventral sutures narrow.

The plant grows on sandy soils. It has been recorded in sandy habitats along the road to the Emirates and surroundings. Flowering from March to May (Plate 49).

8. *LOTONONIS* (*DC.*) *ECKL. ET ZEYH.*

Dwarf herb (our species), with minute trifoliate leaves, racemes mostly terminal, opposite leaves, capitate or rarely 1 to few-flowered. Pod compressed or cylindrical, many seeded dehiscent.

1. ***Lotononis platycarpa*** (*Viv.*) *Pichi-Sermolli*, Webb. 7: 331 (1950); Zohary, Fl. Palaest. 2: 38, t. 49 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 225 (1974).

Lotus platicarpos Viv., Pl. Aeg. 14, no. 14 (1831). *Lotononis dichotoma* (Del.) Boiss., Fl. Orient. 2: 30 (1872). *Lotus dichotomus* Del., Fl. aegypt. Ill. 71, no. 717 (1813), nom. nud., Del. ex Walp., Repert. Bot. Syst. 2: 838 (1843). *Amphinomia platycarpa* (Viv.) Cuford., Bull. Jard. Bot. Brux. Suppl. 25: 227 (1955).

Annual, appressed–tomentose, prostrate with many stems. Leaves 3-foliate, leaflets 4–8 mm, obovate, obtuse. Flowers 1–6, about 1 cm, subsessile, opposite, leaves or

between 2 leaves. Corolla yellowish-white, 6–7 mm long. Pod 5–8 mm, 6–10 seeded, oblong, slightly oblique.

The plant is very common in southern Qatar in sandy habitats. Flowering from February to April (Plate 53).

9. *LOTUS* L.

Herbs or subshrubs with sessile 5-foliate leaves; lower pair of leaflets remote from the 3 proximate upper leaflets, appearing stipule-like (true stipules mostly absent). Flowers usually umbellate on long axillary peduncles, rarely solitary. Legume dehiscent, many-seeded, linear to oblong, straight or curved.

1. Small shrublet; flowers sessile, mauve . 1. *L. garcinii*
2. Annual; flowers on short pedicels, yellow 2. *L. halophilus*

1. *Lotus garcinii* *DC.*, Prodr. 2: 212 (1825); Boiss., Fl. Orient. 2: 174 (1872); Täckh., Stud. Fl. Egypt, ed. 2, 248 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 337 (1978).

Small shrublet, grey canescent, with many thin branches. Leaflets minute, 1–2 mm long. Flowers solitary, sessile, mauve, without bracts; calyx villous cleft to the base, exceeding the small corolla. Fruit oblong, hidden in the persistent calyx.

Rare in Qatar; it grows on maritime calcareous sands in Ras Ushirij, north-west Qatar. Flowering from May to June.

2. *Lotus halophilus* *Boiss. et Sprun.* in Boiss., Diagn. Ser. 1, 2: 37 (1843); Zohary, Fl. Palaest. 2: 92, tt. 134, 134a (1972); Täckh., Stud. Fl. Egypt, ed. 2, 247 (1974); Towns., Fl. Iraq 3: 202 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 338 (1978).

L. villosus Forssk., Fl. Aegypt.-Arab. 71, no. 386 (1775). *L. pusillus* Viv., Fl. Lib. Spec. 47, t. 17, f. 13 (1824); Boiss., Fl. Orient. 2: 173 (1872). *L. aucheri* Boiss., Diagn. Ser. 1, 2: 38 (1843) et Fl. Orient. 2: 173 (1872). *L. pusillus* Viv. var. *major* Boiss., Fl. Orient. 2: 173 (1872).

Annual, small prostrate, silvery pubescent herb. Leaflets narrow elliptical, lower pair a little shorter than others. Peduncles 2–3 times as long as subtending leaves. Racemes 1–4-flowered. Corolla $1\frac{1}{2}$–2 times as long as calyx, pale yellow. Pod 2–4 × 0·1–0·15 cm; cylindrical, slightly compressed and torulose, slightly narrowed between the prominent seeds, obliquely mucronate-beaked.

A common plant in Qatar, especially in the south in sandy habitats. Flowering from February to March.

10. *MEDICAGO* L.

Annual or perennial herbs. Leaves trifoliate with dentate leaflets. Flowers yellow or blue, in pedunclate axillary heads or racemes. Pods usually spirally coiled, discoid to cylindrical, often armed with spines, indehiscent.

In Qatar, there are two wild species in addition to *M. sativa* which is cultivated as a forage plant; sometimes escaping to waste ground and orchards.

1. Flowers blue to purple . . . . 3. *M. sativa*
2. Flowers yellow.
   a. Legume disc-shaped with reticulate faces 2. *M. polymorpha*
   b. Legume globose, spiny . . . . . . 1. *M. laciniata*

1. *Medicago laciniata* *(L.) Mill.*, Gard. Dict., ed. 8, no. 5 (1768); Boiss., Fl. Orient. 2: 104 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 328 (1932); Zohary, Fl. Palaest. 2: 144, t. 211 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 237 (1974); Towns., Fl. Iraq 3: 126 (1974).

Procumbent or ascending annual herb. Stipulates 3–5 mm, dentate to laciniate, hairy beneath. Leaflets dentate to serrate. Racemes 1–2 (–3)-flowered. Peduncles shorter or longer than petiole. Corolla yellow. Pod cylindrical or globular to ovoid, glabrous, spiny; spines 3–4 mm long.

Var. ***brachyacantha*** Boiss., Diagn. Ser. 1, 9: 10 (1849) et Fl. Orient. 2: 104 (1872); Zohary, Fl. Palaest. 2: 144 (1972); Towns., Fl. Iraq 3: 127 (1974). *M. aschersoniana* Urb., Verh. Bot. Ver. Prov. Brandenb. 15: 77 (1872); Post., Fl. Syr., Pal. et Sinai, ed. 2, 1: 318 (1932); Täckh., Stud. Fl. Egypt, ed. 2, 237 (1974); Migahid. Fl. Saudi Arab., ed. 2, 1: 315 (1978).

Stipules dentate, not laciniate; leaflets serrate; rarely somewhat laciniate. Peduncle equalling or shorter than the subtending petiole. Pod shortly cylindrical; coils 2–5.

The plant is common in Qatar, growing on sandy soils. Flowering from March to May. Local name: *Nafal*. Palatable to grazing animals (Plate 50).

2. *Medicago polymorpha* *L.*, Sp. Plant., ed. 1: 779 (1753) emend. Shinners, Rhodora 58: 5 (1956); Zohary, Fl. Palaest. 2: 145, t. 213 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 235 (1974); Towns., Fl. Iraq 3: 130 (1974); Meikle, Fl. Cypr. 1: 421 (1977).

M. hispida Gaertn., Fruct. 2: 349 (1791) emend. Urb., Verh. Bot. Ver. Prov. Brandenb. 15: 74 (1873); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 326 (1932); Mouterde., Nouv. Fl. Syr. 2: 262 (1970); Migahid, Fl. Saudi Arab., ed. 2, 1: 315 (1978).

Annual, glabrous, 10–30 cm, branching from base. Stipules laciniate. Leaflets obovate, obtuse, usualy retuse, serrate or dentate at upper third. Peduncles shorter or longer than petiole. Racemes 2–10-flowered; corolla bright yellow. Pod 0·2–1·2 cm thick and 0·35–1 cm in diameter, discoid glabrous spiny or unarmed; coil surface with many radial veins.

A common weed in gardens, lawns and cultivated *rodat*. Flowering from January to March. Grazed by animals.

3. *Medicago sativa* *L.*, Sp. Plant., ed. 1: 779 (1753); Boiss., Fl. Orient. 2: 93 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 321 (1932); Zohary, Fl. Palaest. 2: 140, t. 204 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 237 (1974); Towns., Fl. Iraq 3: 121 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 315 (1978).

Erect perennial herb, 30–90 cm, much branched. Stipules lanceolate-acuminate, 4–8 mm, the lower toothed at the base, the upper commonly entire. Leaflets dentate at apex, 2·5–4 cm long. Inflorescence dense, racemes, 10–25 flowered; peduncles 2–4 cm, exceeding the leaves. Corolla lilac to purple, rather more than twice as long as the calyx. Pod spiral, with 2–3 lax coils, 4–8 mm diameter, dark-brown or blackish when ripe.

The plant is commonly cultivated as fodder. It has proved to be successful in Qatar as it tolerates drought and salinity; it also benefits the soil by increasing its nitrogen content

due to the action of bacteria in the root nodules. The plant is parasitized by dodder (*Cuscuta*) in some parts of Qatar.

The local name is *Jatt*, which is used throughout Arabia and Iraq. Perhaps the name alfalfa is derived from the Arabic *Alaf* (fodder) (cf. Towns., Fl. Iraq 3: 123, 1974).

The plant flowers by the advent of summer from May to July (Plate 50).

11. *MELILOTUS MILL.*

Annuals or biennials, often smelling of coumarin especially when dried. Leaves trifoliate; stipules adnate to petiole. Flowers yellow or white in pedunculate racemes. Legume ovate or globose, 1- (rarely 2–4-) seeded, unarmed.

1. Flowers white . . . 1. *M. albus*
2. Flowers yellow . . . 2. *M. indicus*

1. *Melilotus albus* *Medik. ex Desr.* in Lam., Encycl. 4: 63 (1797); Boiss., Fl. Orient. 2: 109 (1872; *alba*); Zohary, Fl. Palaest. 2: 154, t. 224 (1972); Meikle, Fl. Cypr. 3: 433 (1977).

M. alba Medik., Voil. Churpf. Phys. Oken. Ges. 2: 382 (1978) *nom. nud.*; Täckh., Stud. Fl. Egypt, ed. 2, 238 (1974); Towns., Fl. Iraq 3: 144 (1974).

Biennial or annual, tall plant, 30–200 cm high. Stipules entire. Leaflets of lower leaves obovate to rhombic, leaflets of upper leaves linear or narrowly elliptical. Racemes many-flowered, much elongated and lax in fruits. Flowers white. Pod 3–3·5 mm, 1–2-seeded, somewhat compressed, rather ellipsoidal, with a short, sharp curved beak at tip.

The plant grows as a weed in gardens, along irrigation channels and moist places. Flowering from March to April (Plate 50).

2. *Melilotus indicus* (*L.*) *All.*, Fl. Pedem. 1: 308 (1785; *indica*); O. E. Schulz. in Engl., Bot. Jahrb. 29: 317 (1901); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 330 (1932); Zohary, Fl. Palaest. 2: 156, t. 230 (1972); Meikle, Fl. Cypr. 1: 434 (1977).

Annual, glabrous except in the younger parts, 20–40 cm, stems and branches wiry. Stipules entire or denticulate below. Leaflets obovate to oblong–cuneate, upper half dentate or rarely entire. Raceme elongating in fruit, many-flowered. Flowers 2·5–2·8 mm (in the former species 5 mm). Corolla pale yellow. Pod 1·8–2·8 mm, globular, obtuse, mucronulate, yellow, with reticulate ridges or wrinkles.

Very common weed in cultivated land. Flowering from March to April. Known in other Arab countries as *Handaquq*.

12. *ONONIS L.*

Annual herbs (our species), mostly furnished with simple and glandular hairs. Leaves mostly short-petioled or sessile, mostly of 3 dentate–serrate leaflets, sometimes reduced to leaflet only; stipules large, leaf-like. Flowers axillary, solitary or 2–3 together, often in terminal leafy racemes. Calyx campanulate. Corolla with various colours, pink to bluish-purple in our species. Legume oblong or linear, exerted from or enclosed in calyx.

\+ Stipules dentate; flowers pink; peduncles not produced into an arista beyond the point of insertion of the pedicel . . . . 1. *O. reclinata*
\+ + Stipules entire; flowers yellow; peduncles produced into an arista beyond the point of insertion of the pedicel . . . . . . 2. *O. sicula*

1. *Ononis reclinata* *L.*, Sp. Plant., ed. 2: 1011 (1763); Boiss., Fl. Orient. 2: 61 (1872); Sirj., '*Generis Ononis* L. *Revisio critica*'; Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 308 (1932); Towns., Fl. Iraq 3: 86 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 315 (1978).

O. mollis Savi, Mem. Moden. 9: 351, t. 8 (1801).

O. reclinata L. var. *minor* Moris, Fl. Sardoa 1: 422 (1837); Täckh., Stud. Fl. Egypt, ed. 2, 229 (1974).

O. reclinata L. var. *mollis* (Savi) Heldr., Bull. Herb. Boiss. 6: 292 (1898).

Annual herb, 3–20 cm, much branched from the base, covered with glandular hairs and silky simple hairs. Leaves trifoliate, the upper and lower rarely unifoliate, denticulate along the apex; uppermost leaves small and narrower. Inflorescence a leafy raceme. Flowers pink to bluish-purple, solitary, on 5–8 mm peduncles which deflex strongly at the apex in fruit so that the pods are pendulous. Corolla shorter than calyx. Pod linear–oblong, somewhat longer than calyx. Rare in Qatar.

2. *Ononis sicula* *Guss.*, Cat. Pl. Boccad. 78 (1821); Boiss., Fl. Orient. 2: 60 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 307 (1932); Towns., Fl. Iraq 3: 82 (1974); Täckh., Stud. Fl. Egypt, ed. 2, 229 (1974).

Erect annual herb; pale or yellowish-green, 5–30 cm, much branched from the base, densely covered with fine, unequal glandular hairs and longer patent simple hairs. Leaves trifoliate, petiole 5–10 mm, the terminal leaflet larger than the laterals. Peduncles slender, solitary, axillary, subtending leaves, produced into a fine, 4–8 mm, arista. Flowers solitary, yellow, on short (2–3 mm) downwardly deflexing pedicle, in leafy racemes. Calyx 7–10 mm. Corolla 6–9 mm. Pod linear–oblong, straight, not compressed, 10–15 × 3–4 mm. Seeds reniform, light brown. Rare in Qatar. Flowering in March.

13. *PSORALEA* L.

Shrubs or suffrutecose perennials, with black or pellucid–punctate glands. Leaves trifoliate (in our species); leaflets dentate. Inflorescence spicate (our species). Flowers small, blue to purple, often veined. Legume small, ovate, indehiscent.

Psoralea from the Greek *psoraleos*, scurfy or warty—alluding to the rough warted surface, due to the glandular dots in this genus.

1. *Psoralea plicata* *Del.*, Fl. aegypt. Ill. 322 (1813); Boiss., Fl. Orient. 2: 186 (1872); Blatter, Fl. Arab. 8: 142 (1921); Täckh., Stud. Fl. Egypt, ed. 2, 252 (1974).

Grey canescent shrublet, glandular dotted. Leaves trifoliate, petiolate, stipulate. The central leaflets larger than the others, all repand–undulated. Flowers small, violet, in whorls of 2–3 together forming lax axillary racemes. Legume small, 1-seeded, beaklers, included in the calyx, on deflexed pedicels.

The plant occurs only in southern Qatar, along the Emirates' road at Al-Amiriyah

where it dominates a community occupying a limited area along the main channel of a wide shallow runnel. It is overgrazed in this locality. It has been recorded also in a protected *roda* in Trainah where it grows on waste land adjacent to irrigated trees and vegetables. Flowering from March to May (Plate 51).

14. *RHYNCHOSIA LOUR*

Twining perennials with trifoliate leaves. Leaflets stipuled, entire, with glandular dots below. Leaf-stipule ovate. Flowers yellow, rarely purple, in axillary racemes. Legume small flat, not partitioned, 2-seeded.

1. *Rhynchosia minima* (*L.*) *DC.*, Prod. 2: 335 (1825); Andrews, Flow. Pl. Anglo-Egypt. Sud. 2: 228 (1952); Täckh., Stud. Fl. Egypt, ed. 2, 284 (1974); Migahid, Fl. Saudi Arab., ed. 2, 338 (1978).

Twiner or suberect perennial herb, glabrous to slightly pubescent. Leaflets orbicular or broad-ovate, 1·5–2·5 cm in diameter. Flowers yelow, in lax 6–12-flowered racemes, 5–10 cm long. Pod about 2 cm long, 0·5 cm broad, soon glabrous, 2-seeded. Seeds mottled with black.

The species is represented in Qatar by var. ***minima***, with broad ovate leaflets.

The plant is rare in Qatar; it was recorded only in Al-Magdah depression, northern Qatar, climbing the *Ziziphus nummularia* bushes. Flowering from March to April.

15. *SCORPIURUS L.*

Annual herbs with simple, entire, petioled leaves. Inflorescence axillary, long-pedunclate, umbellate. Flowers yellow or reddish. Pods subterete, coiled in 1 to several turns, constricted between segments, grooved or crested lengthwise or covered with warts, protuberances or prickles along crests.

Scorpiurus from a Greek name, indicating the fancied resemblance of the pod to a scorpion's tail.

1. *Scorpiurus muricatus* *L.*, Sp. Plant, ed. 1, 745 (1753), emend. Lam., Fl. Franc., ed. 1, 2: 582 (1778); Boiss., Fl. Orient. 2: 178 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 363 (1932); Zohary, Fl. Palaest. 2: 98, t. 146 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 249 (1974); Towns., Fl. Iraq 3: 450, t. 88 (1874); Meikle, Fl. Cypr. 1: 506, t. 28 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 314 (1978).

Annual; stems angular; leaves abovate-spathulate 3–8 cm long, 3–5 nerved, petiolate. Inflorescence axillary, long-pedunclate, umbellate, 2–4-flowered. Flowers 1–1·5 cm long, loosely coiled as to form a ring only, constricted between seeds, longitudinally ridged, ridges smooth or tuberculate or covered with simple or hooked or 2-fid prickles.

Var. ***muricatus***.

Pod furnished with short straight tubercles, usually coiled in one plane only.

The plant is reported only from northern Qatar in the *rodat*, particularly cultivated ones or receiving considerable amounts of runoff water. Flowering from March to April (Plate 52).

16. *TAVERNIERA* DC.

Undershrubs with uni- or trifoliate leaves. Flowers axillary arranged in a raceme, pink, white or flesh-coloured. Pod compressed, indehiscent, 2–3 flattened elliptical joints, beset with bristles or unarmed.

1. ***Taverniera aegyptiaca*** *Boiss.*, Diagn. Ser. 1, 9: 113 (1843); Täckh., Stud. Fl. Egypt, ed. 2, 270, t. 84 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 336 (1978).

Small shrubby plant, with virgate branches. Leaves few, simple, sometimes lower leaves trifoliate, the lower leaves larger than upper leaves, entire, orbicular, with rounded apex, on short petiole. Flowers short-pedicelled. 1–2 flowers in the leaf axils. Calyx adpressed strigose-hairy. Corolla flesh-coloured, 7–10 mm long, longitudinally veined, often still adherent to the fruit. Pod compressed, 2-segmented, with bristles.

Rare in Qatar. It occurs in long runnels dissecting the Miocene country in southern Qatar. Flowering from March to April (Plate 52).

17. *TRIFOLIUM* L.

Annual or perennial herbs. Leaves mostly with 3 dentate or, entire leaflets. Stipules adnate to petiole. Inflorescence compact, spicate, capitate or umbellate. Flowers white, yellow, blue or shades of red. Pod small, not coiled, indehiscent, mostly 1–2-seeded, enclosed in the persistent calyx.

Trifolium, the name in Pliny of a plant with 3-foliate leaves: *tri*, three, *folium*, leaf.

1. ***Trifolium resupinatum*** *L.*, Sp. Plant., ed. 1, 771 (1753); Boiss., Fl. Orient. 2: 137 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 344 (1932); Zohary, Fl. Palaest. 2: 170, t. 244 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 241 (1974); Towns., Fl. Iraq 3: 176 (1974).

Erect, decumbent or prostrate, glabrous or glabrescent annual, 15–30 cm, much-branched. Petioles of lower leaves much longer than those of upper leaves. Leaflets obovate, rather distinctly nerved, nerves ending in sharp, distinctly mucronate teeth. Inflorescences generally exceeding petioles; flowers crowded, sessile, with small scarious bracts; resupinate. Corolla pink to mauve, about twice as long as the calyx. Pod ovoid, enveloped by the inflated calyx.

Rare in Qatar; a weed among irrigated crops, especially in well-irrigated lawns. Flowering from March to April.

18. *TRIGONELLA* L.

Herbs, usually annual, rarely perennial. Leaves 3-foliate, denticulate or rarely entire. Racemes axillary, many, rarely 1-flowered, sometimes umbellate or spicate. Flowers yellow, white lilac or rarely bluish. Legume variable in shape.

Trigonella, the diminutive from the Latin *trigonos*, triangular.

1. Flowers in peduncled racemes, fruiting peduncle as long or longer than the petiole of the subtending leaf . . . . 2. *T. hamosa*
2. Flowers sessile or subsessile, umbelliform.
   a. Pods wavy, eel-like, 4–7 mm . . . . 1. *T. anguina*
   b. Pods not wavy, 4–8 mm . . . . 4. *T. stellata*
3. Flowers solitary or in pairs in the leaf axils, sessile or subsessile, pods 4–7 cm . . . . 3. *T. monantha*

1. *Trigonella anguina* *Del.*, Fl. aegypt. Ill. 254, t. 38, f. 2 (1813); Boiss., Fl. Orient. 2: 86 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 318 (1932); Täckh., Stud. Fl. Egypt, ed. 2, 233 (1974); Towns., Fl. Iraq 3: 93 (1974).

Prostrate annual herb, branched from the base. Petiole 4–15 mm. Leaflets subequal or the central somewhat larger. Flowers yellow, 2–7-fasciculate in a more or less sessile axillary umbel; pedicels very short, *ca.* 1 mm. Legume sessile, spreading in star-shape, wavy, 4–7 mm, 2–6 seeded, with a persistent style.

A common plant on the alluvial deposits in depressions, especially in northern Qatar. Palatable to sheep and goats.

Local name: *Nafal*, a name given for many herbaceous legumenous plants in Qatar as well as Arabia. Flowering from March to April (Plate 53).

2. *Trigonella hamosa* *L.*, Syst. Nat., ed. 10, 1180 (1759); Boiss., Fl. Orient. 2: 84 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 317 (1932); Mout., Nouv. Fl. Syr. 2: 250 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 233, t. 74 (1974); Towns., Fl. Iraq 3: 91 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 316 (1978).

Annual, much branched from the base, prostrate or decumbent erect, 10–50 cm. Stipules 4–6 mm, the lower broad-based and coarsely dentate, the upper often merely semisagittate. Leaflets cuneate–oblong to cuneate–ovate, sharply denticulate above, retuse at the apex. Racemens 6–12-flowered, on 1·5–3 cm peduncles. Corolla yellow, about twice as long as calyx. Pod linear, slightly curved, acute, reticulate-veined with short-mucronate tip.

The plant is a very common weed in gardens and fields. Flowering from March to April (Plate 53).

3. *Trigonella monantha* *C. A. Mey.*, Verz. Pfl. Cauc. 137 (1831); Boiss., Fl. Orient. 2: 77 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 314 (1932); Zohary, Fl. Palaest. 2: 132, t. 195 (1972); Towns., Fl. Iraq 3: 104 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 316 (1978).

Annual, prostrate or ascending herb, much-branched from the base. Leaflets 3–8 × 3·6 mm, obovate, acutely dentate or incised near tip, rounded or truncate at apex. Flowers solitary or in pairs; peduncles and pedicels very short or absent. Corolla yellow. Pod terete, 5–7 cm, erect, straight or slightly curved, hairy, ending in a sharp-pointed hook.

Rare in Qatar. Flowering from March to May.

4. *Trigonella stellata* *Forssk.*, Fl. Aegypt.-Arab. 140 (1775); Boiss., Fl. Orient. 2: 85 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 317 (1932); Täckh., Stud. Fl. Egypt, ed. 2, 233, t. 74 (1974); Towns., Fl. Iraq 3: 94 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 316 (1978).

Annual, mostly prostrate, much-branched. Petioles long, 1–6 cm. Leaflets obcordate, retuse. Racemes sessile or almost so, 5–10-flowered, subumbelliform, pedicels very short. Corolla yellow, twice as long as the calyx. Pods stellate-spreading, 4–8 mm long, delfexed.

Variable in shape, in dry habitats small, mat-shaped, with thick frutescent stems, in wet or shady habitats long slender herbaceous.

Very common in Qatar in sandy places. Palatable to sheep and goats. Local name: *Nafal*. Flowering from February to April (Plate 54).

19. *VICIA* L.

Herbs, annual (in our species), with paripinnate leaves, the leaf rachis terminating in a simple or branched tendril or a spine-like cusp. Flowers with various colours; sessile and solitary or in clusters in leaf axils. Stamens diadelphous. Legume compressed, dehiscent.

1. *Vicia monantha* *Retz.*, Obs. Bot. 3: 39 (1783); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 423 (1932); Zohary, Fl. Palaest. 2: 199, t. 284 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 278 (1974); Towns., Fl. Iraq 3: 521 (1974).

Erect or decumbent annual, brlanching below, sparingly hairy to glabrous. Leaves peripinnate with 4–8 pairs of leaflets, rachis terminating in a simple or branched tendril; lower petioles *ca.* 4–10 mm, upper leaves subsessile. Leaflets linear and acute to linear-oblong, obtuse and mucronate. Flowers pedunculate, in an axillary 1–3-flowered raceme, violet-blue. Peduncles shorter than leaves, terminating in a 1–3 mm cusp. Corolla about twice as long as the calyx. Pod 2–4 cm long, short-stipitate, 4–6-seeded, oblong–linear, glabrous. Seeds spherical, 3–4 mm, dark brown or mottled.

It is rare in Qatar, often in segetal and ruderal habitats (fields, roadsides). Flowering from April to May. The plant is palatable to grazing animals.

18. *OXALIDACEAE* R. BR.

Usually herbs with acid juice. Leaves alternate, opposite or radical, compound (in our species digitate). Flowers solitary or in cymes, bisexual, 5-merous with no disc. Stamens 10, obdiplostamonous, united at base (monadelphous). Ovary superior, 5-carpelled, ovules 1 to many in each locule. Fruit a loculicidal capsule (our species) or berry.

1. *OXALIS* L.

Perennial herbs, sometimes with tuberous stem. Leaves palmately trifoliate (in our species), leaflets usually emarginate. Flowers actinomorphic, bisexual, pentamerous. Stamens 10, monadelphous at the base with 5 long and 5 short filaments, alternating with each other. Ovary 5-lobed, 5-locular, without a beak, ovules 1 to many in each loculus; styles 5. Fruit a loculicidal capsule. Seeds with elastic testa, which helps in dispersal.

+ Flowers small, petals 4–8 mm; plant with spreading or creeping stems, without bulbils . . . . 1. *O. corniculata*
+ + Flowers large, petals 15–25 mm; plant without aerial stems; bulbils present at base of leaves and along underground stem . 2. *O. pes-caprae*

1. *Oxalis corniculata* *L.*, Sp. Plant., ed. 1, 435 (1753); Boiss., Fl. Orient. 1: 867 (1867); Kunth in Engl., Pflanzenr. 95 (IV, 130): 146 (1930); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 253 (1932); Davis, Fl. Turkey 2: 490 (1967); Zohary, Fl. Palaest. 2: 225, t. 321 (1972); Täckh., Stud. Fl. Egypt ed. 2, 293 (1974); Ali, Fl. Lib., 7: 1–3 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 124 (1978).

A creeping annual with a slender taproot; stems much-branched and often rooting at the nodes. Stem hairy. Leaves alternate, digitately 3-foliate, leaflets obcordate, emarginate, tomentose on the lower side; stipules auriculate. Inflorescence axillary, umbellate, 1–7-flowered, peduncle 3–8 cm or more long; bracts linear–subulate; pedicles 0·8–1·5 (–3) cm long. Petals yellow, 4–8 mm long, about 3 mm wide, apex rounded. Stamens in two series, connate in a basal tube about 1 mm long. Ovary narrowly conical, 5-furrowed, about 1·5 mm long, 0·5 mm wide. Capsule cylindrical, 1–2 cm long, 0·3–0·4 cm wide, 5-furrowed, hairy. Seed ovate–elliptical, strongly compressed, transversely ribbed. A weed of lawn and gardens in Qatar.

2. *Oxalis pes-caprae* *L.*, Sp. Plant., ed. 1: 434 (1753); Salter in Journ. S. Afr. Bot. 5: 47–52 (1939).

O. cernua Thunb., Diss. oxalis, 14 (1781); Kunth in Engl., Pflanzenr. 95 (IV, 130): 297 (1930); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 254 (1932); Davis, Fl. Turkey 2: 488 (1967); Zohary, Fl. Palaest. 2: 255, t. 320 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 293 (1974); Meikle, Fl. Cypr. 1: 346 (1977); Ali, Fl. Lib. 7: 3–4 (1977).

An erect perennial with a slender, bulbiferous underground stem. Leaves densely clustered at apex of stem, 3-foliate, leaflets obcordate, glabrous above, the lobes of the lateral leaflets frequently somewhat unequal; petiole slender 5–15 cm or more long; stipules narrow, membranous, ciliate, adnate to base of petiole throughout their length. Inflorescence umbellate, 3 to many flowered; peduncle stout, often 30 cm long, usually rising well above leaves. Petals bright yellow, large and showy, 15–25 mm long and 10–13 mm wide with rounded apex. Stamens 10 in two series, about 0·6 and 0·8 mm long Ovary oblong cylindrical, 2·5–3 mm long, about 1·5 mm wide. Fruits rarely produced.

Collected along the road to Al-Khor in irrigated hollows of cultivated trees along the road. Flowering from March to April (Plate 55).

19. *GERANIACEAE* *A. JUSS.*

Herbs or undershrubs; leaves stipulate, lobed or divided. Flowers hermaphrodite, actinomorphic; sepals 5 (rarely 4), free or connate at base; petals 5 (or 4, or occasionally wanting), free; stamens 2–3 times as many as sepals, obdiplostamenous; ovary superior, 3–5 lobed. Fruit often beaked, splitting (often elastically) into 1 (rarely more) seeded dehiscent portions at maturity.

1. Leaves palmate-nerved. 2. *Geranium*
2. Leaves pinnate-nerved.
   a. Stamens 5 . . . 1. *Erodium*
   b. Stamens 15 . . . 3. *Monsonia*

1. *ERODIUM* *L'HER.*

Annual or perennial herbs with or without woody stock. Leaves pinnate-nerved, rarely undivided. Inflorescence usually umbellate, pedunclate, bracteate. Sepals 5; petals 5. Anther-bearing stamens 5; staminodes 5. Fruit a schizocarp, splitting into long-beaked

mericarps; beak separating from the axis and twisting in its lower part. Mericarps usually with a pit on either side of apex (beneath the peak).

A. Beak bursting from the top into 5 plumose valves, central column lacking. Perennials.
   1. Petals 6 mm long, hardly exceeding the calyx . . . . . 1. *E. bryoniaefolium*
   2. Petals up to 15 mm long, longer than calyx . . . . . 2. *E. glaucophyllum*
B. Beak bursting from below into 5 slightly bristly valves, central column present. Annuals . . . . 3. *E. laciniatum*

1. *Erodium bryoniaefolium* *Boiss.*, Diagn. Ser. 1, 1: 61 (1843) 'bryoniaefolium' et Fl. Orient. 1: 896 (1867); Kunth in Engl., Pflanzenr., Geraniac. 226 (1912); Burtt et Lewis, Kew Bull. 1954, 3: 400 (1954); Zohary, Fl. Palaest. 2: 234 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 296 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 134 (1978).

Prostrate annual or perennial herb. Leaves usually obscurely 3–5-lobed, grey canescent. Peduncles as long as or longer than the subtending leaves. Umbels 3–6-flowered. Bracts, broadly membranous-margined, woolly. Mericarps 4 mm, with 1 very shallow furrow beneath beak; beak about 8–12 cm, feathery all along.

Rare in Qatar. It grows in *rodat* of northern Qatar. Flowering from April to May.

2. *Erodium glaucophyllum* *(L.) L'Her.*, in Ait., Hort. Kew, ed. 1, 2: 416 (1789); Boiss., Fl. Orient. 1: 895 (1867), Zohary, Fl. Palaest. 2: 234, t. 333 (1972). *E. glaucophyllum* (L.) Ait., Burtt et Lewis 1954, 3: 403 (1954); Täckh., Stud. Fl. Egypt, ed. 2, 296 (1974). *Geranium glaucophyllum* L., Sp. Plant., ed. 1, 679 (1753) et ed. 2, 952 (1763). *G. crassifolium* Forssk., Fl. Aegypt.-Arab. 123 (1775).

Perennial, glabrous or nearly so, 10–40 cm. Roots with interrupted, oblong thickenings. Stems few, prostrate; stipules membranous. Lower leaves crowded. Peduncles longer than the subtending leaves. Umbels 3–5-flowered; bracts hairy. Sepals 5 mm long, elongating in fruit, membranous-margined, ending with a long purplish mucro. Petals purple, $1\frac{1}{2}$ times as long as sepals. Mericarps 3–5 mm, with 2 furrows beneath beak; beak up to 8 cm, lower part not feathery.

Rare in Qatar, usually growing in depressions and in gardens. Flowering from March to April (Plate 55).

3. *Erodium laciniatum* *(Cav.) Willd.*, Sp. Plant., ed. 3, 633 (1800); Boiss., Fl. Orient. 1: 893 (1867); Kunth in Engl., Pflanzenr., Geraniac. 241 (1912); Burtt et Lewis, Kew Bull. 1954, 3: 404 (1954); Zohary, Fl. Palaest. 2: 240 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 297 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 134 (1978).

Annual, very variable especially in indumentum, form of calyx and involucre. Stems prostrate. Leaves stipulate; blades of lower leaves mostly cordate-ovate, obscurely 3-lobed, blades of the others 3-lobed or 1–2 pinnatipartite or pinnatisect into short narrow lobes. Bracts 2 or more. Petals longer than sepals. Mericarps 4–8 mm, without furrows beneath pits; beak 4–8 cm.

Var. ***laciniatum.*** *E. laciniatum* (Cav.) Willd., Sp. Plant., ed. 3, 633 (1800); Zohary, Fl. Palaest. 2: 240, t. 345 (1972). *Geranium laciniatum* Cav., Monad. Class. Dissert. 228, t. 113, f. 3 (1787). *Erodium laciniatum* (Cav.) Willd. var. *involucratum* (Kunze) Willk. et

Lange, Prodr. Fl. Hisp. 3: 539 (1878). *E. triangulare* sensu Muschl. Man. Fl. Eg. 558 (1912). *Geranium triangulare* Forssk., Fl. Aegypt.-Arab. 123 (1775) nom. ambig. *G. maritimum* Forssk., l.c., non L., Syst., ed. 10, 2: 1143 (1758) nec Burm. f., Spec. Geran. 46 (1759).

Green plants with short hairs, often appressed on the leaves. Bracts mostly 2, 3–5 m across much broader than long. Sepals with a mucro 1·5–2 mm. Fruiting beak 4–6 cm long.

Var. ***pulverulentum*** *(Cav.) Boiss.*, l.c.; Kunth, l.c. 243; Zohary, l.c. 241, t. 345. *G. pulverulentum* Cav., l.c. 272, t. 125, f. 1 (1788); Desf., Fl. Atl. 2: 111 (1798). *Eradium pulverulentum* (Cav.) Willd., l.c. 632. *E. subtrilobum* Jord. ssp. *pulverulentum* (Cav.) Vierh., Verh. Zool.-Bot. Ges. Wien 69: 133 (1919).

Mostly pilose to tomentellous plants. Lower leaves rather simply lobed, but those further up the stem become more deeply divided as in the type. Bracts mostly more than 2, small, usually 2·5 mm or more. Sepals with a mucro 0·5–1 mm. Indumentum dense; upper parts of plant never glabrescent. Beak 3–5 cm.

Both varieties of *E. laciniatum* are common in Qatar. Plants grow in depressions on sandy and loamy soil. Flowering is mainly from March to April (Plate 56).

2. *GERANIUM* L.

Annual or perennial herbs. Stems frequently forked, often swollen at nodes. Leaves palmately lobed or dissected. Peduncles 1–3-flowered. Stamens 10, fertile. Fruit a schizocarp; mericarps usually dehiscent, 1-seeded, separating from axis elastically and curling upwards at maturity, the apex of the beak often remaining attached to the central axis.

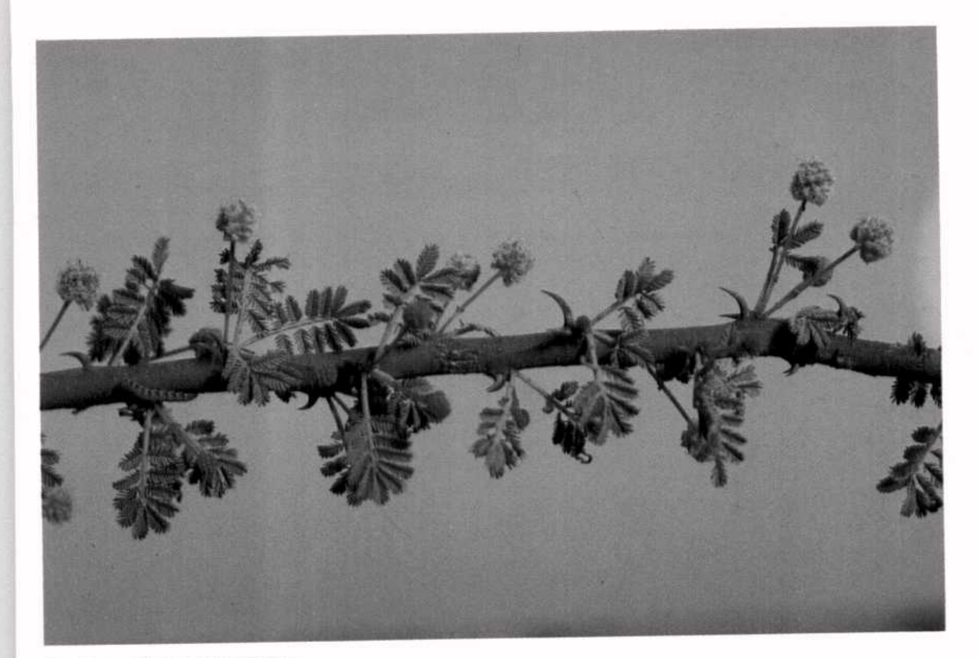
1. ***Geranium molle*** *L.*, Sp. Plant., ed. 1, 632 (1753); Boiss., Fl. Orient. 1: 882 (1867); Kunth in Engl., Pflanzenr., 53 (IV, 129): 57 (1912); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 257 (1932); Davis, Fl. Turkey 2: 459 (1967); Zohary, Fl. Palaest. 2: 230, t. 328 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 295 (1974).

A decumbent or sprawling annual. Rootstock thick. Stems diffusely branched from base. Leaves stipulate, petioles of lower leaves longer than those of upper leaves; blade round to reniform in outline, palmately 5–9-fid, upper leaves alternate, usually smaller and more deeply lobed. Peduncles 2-flowered. Pedicals 1–1·5 cm long, upturned towards apex in fruit. Petals pink or purple, slightly longer than sepals. Mericarps 1·5–2 cm, with a beak 8–9 mm long.

The plant is recorded at Doha and northwards. it grows in depressions (*rodat*) receiving considerable amounts of runoff water, also in gardens as a weed; often in shady places or fields. Flowering from March to May (Plate 56).

3. *MONSONIA* L.

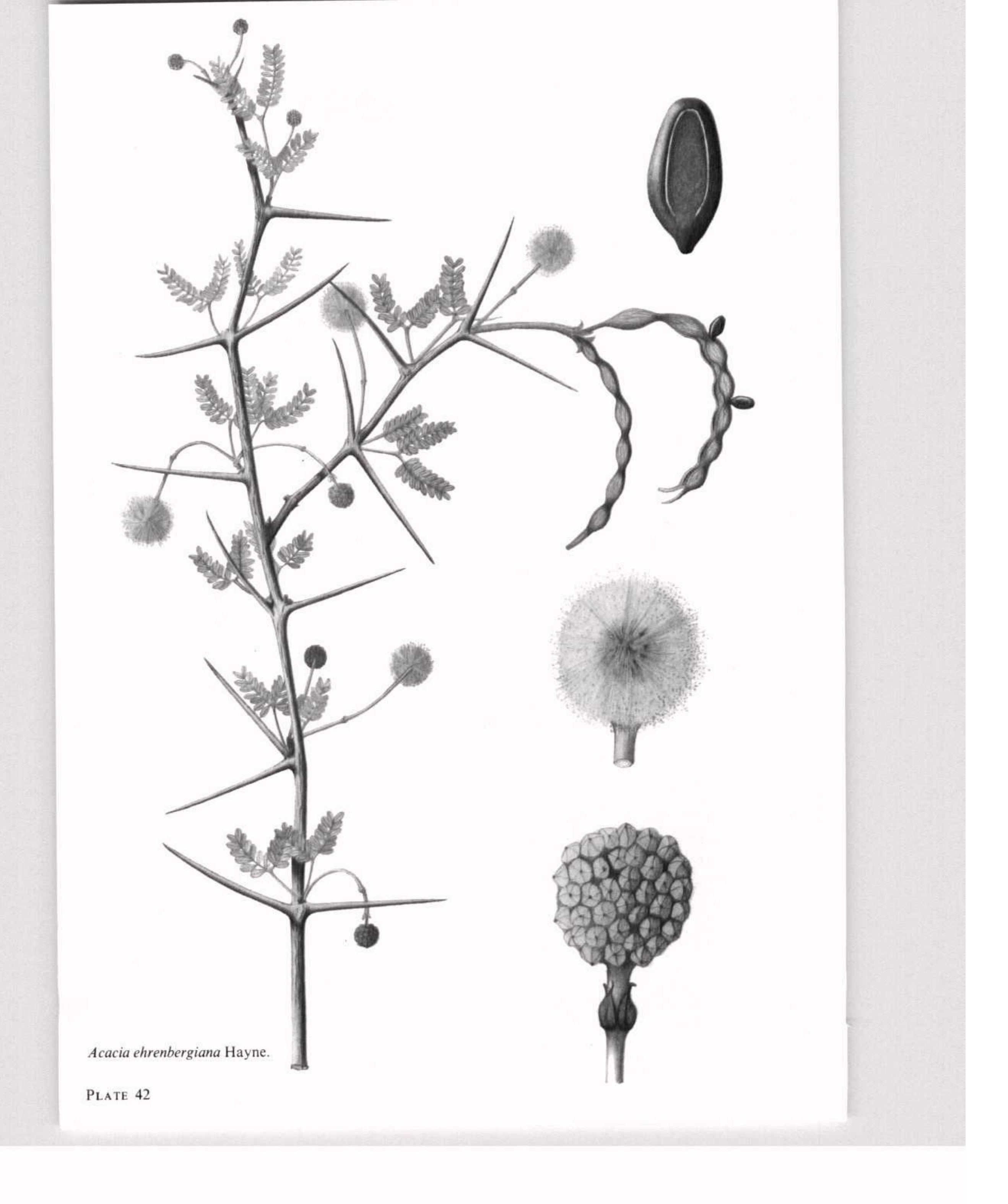
Perennial herbs, sometimes woody at base. Peduncles axillary; flowers actinomorphic. Calyx in fruiting stage wide red above, obconical. Petals 5, caducous. Stamens 15, fertile. Fruit a schizocarp with indehiscent mericarps separating from the axis as in *Erodium*; beak pilose or plumose.



Acacia tortilis (Forssk.) Hayne.

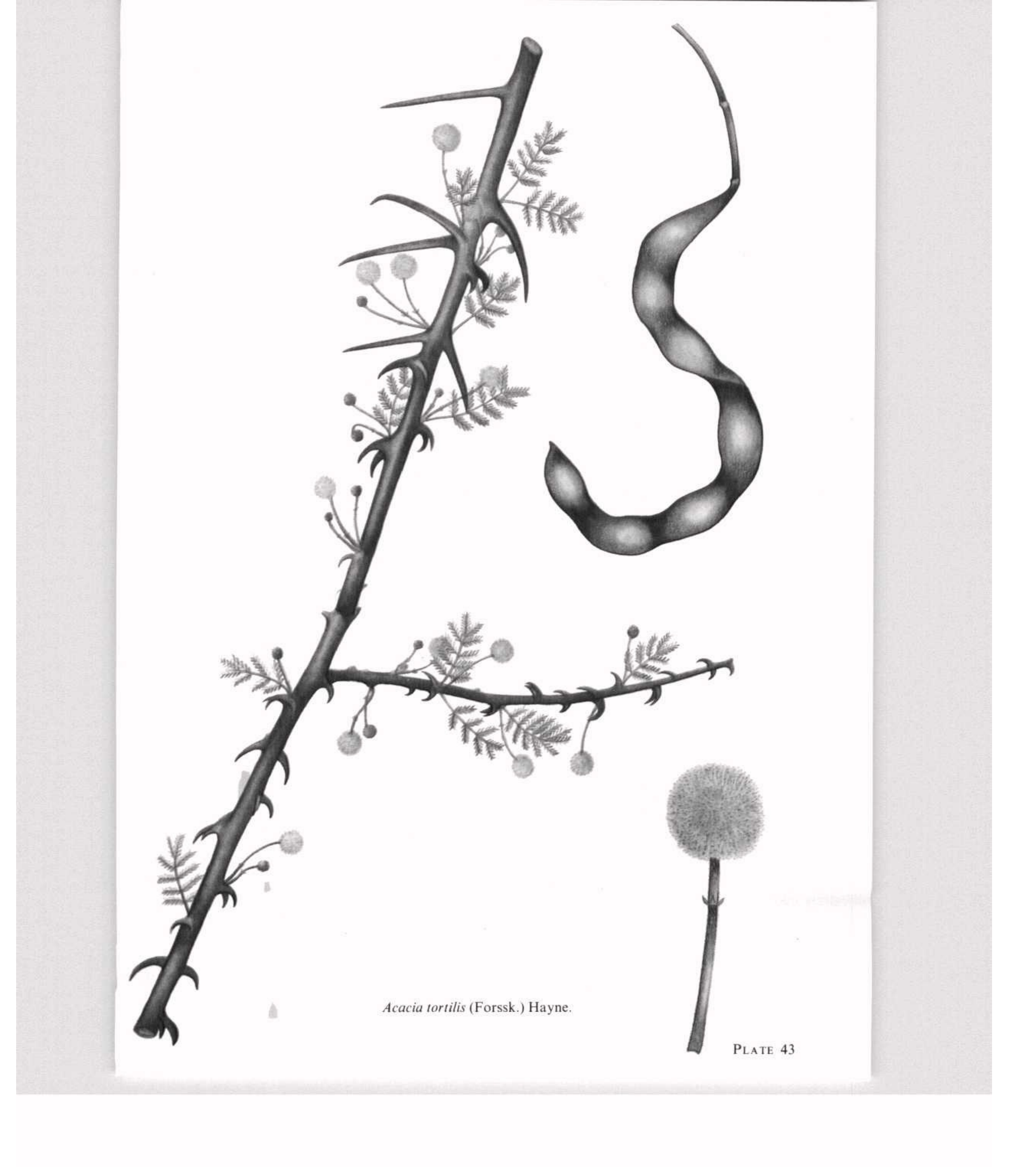


Acacia ehrenbergiana Hayne.

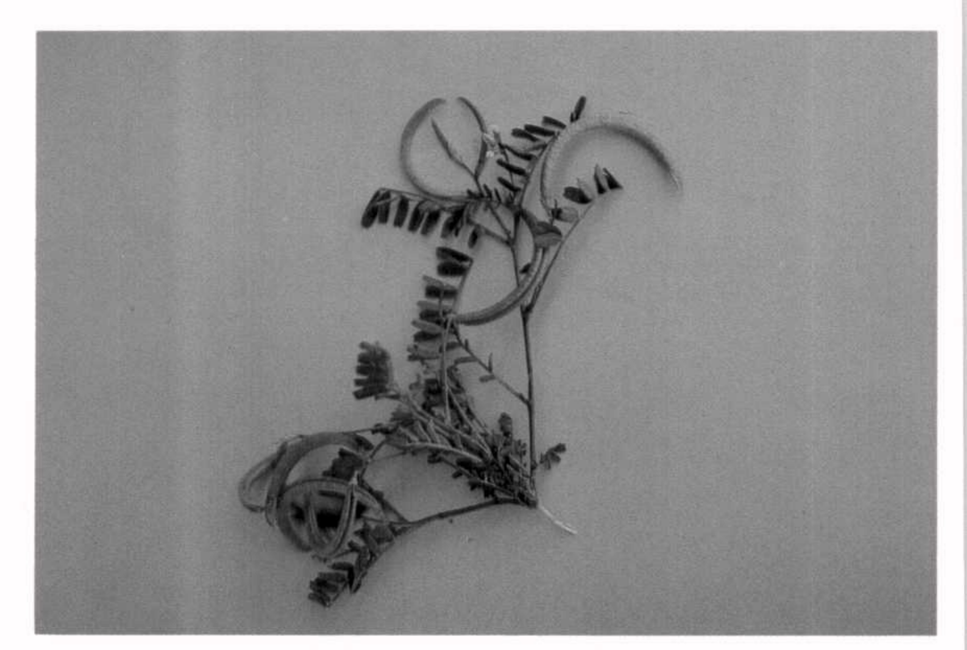


Acacia ehrenbergiana Hayne.

PLATE 42



Acacia tortilis (Forssk.) Hayne.



Astragalus corrugatus Bertol.



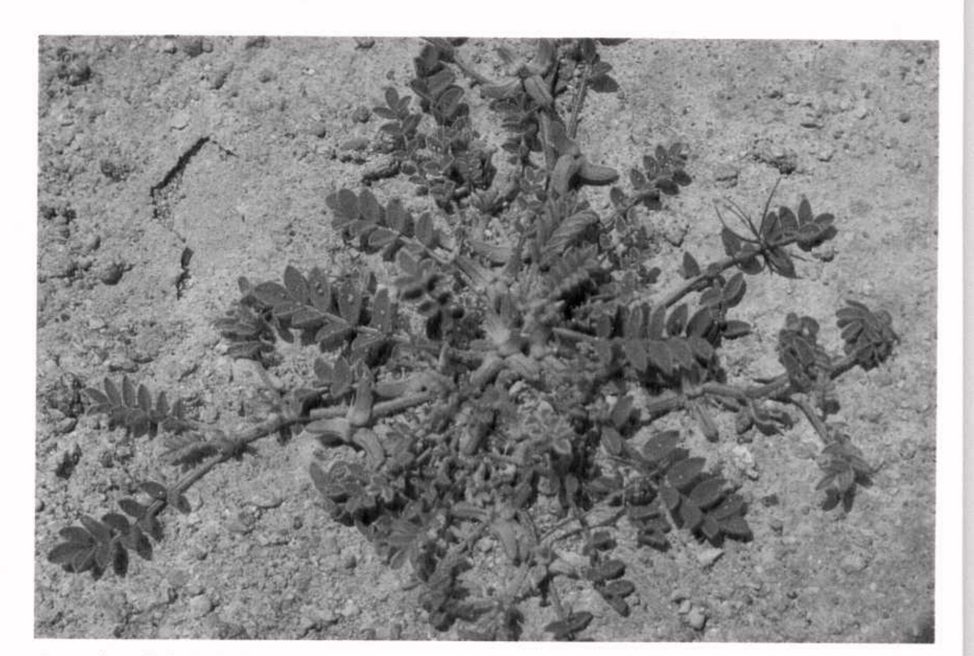
Astragalus eremophilus Boiss.



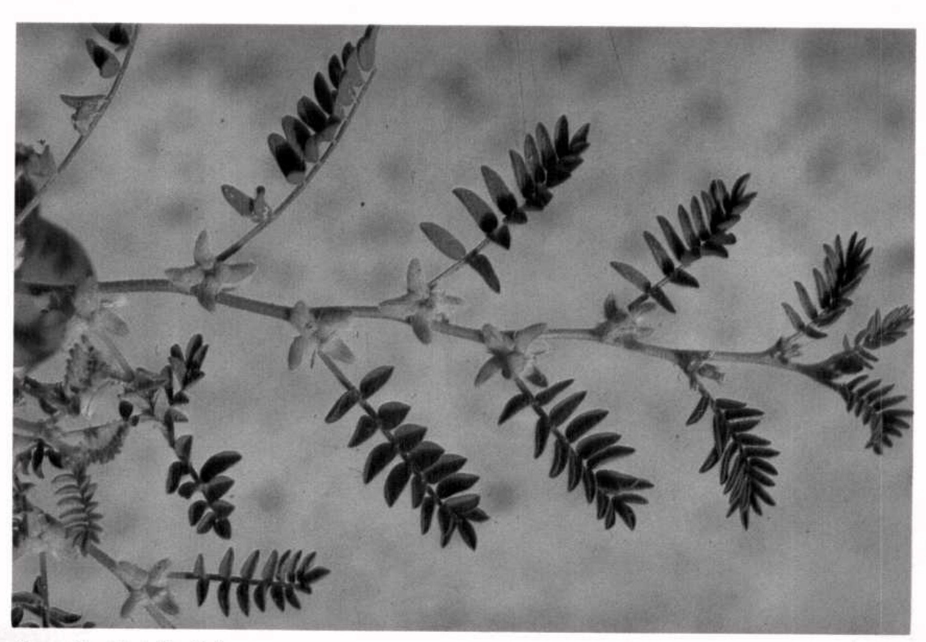
Astragalus hamosus L.



Astragalus sieberi DC.



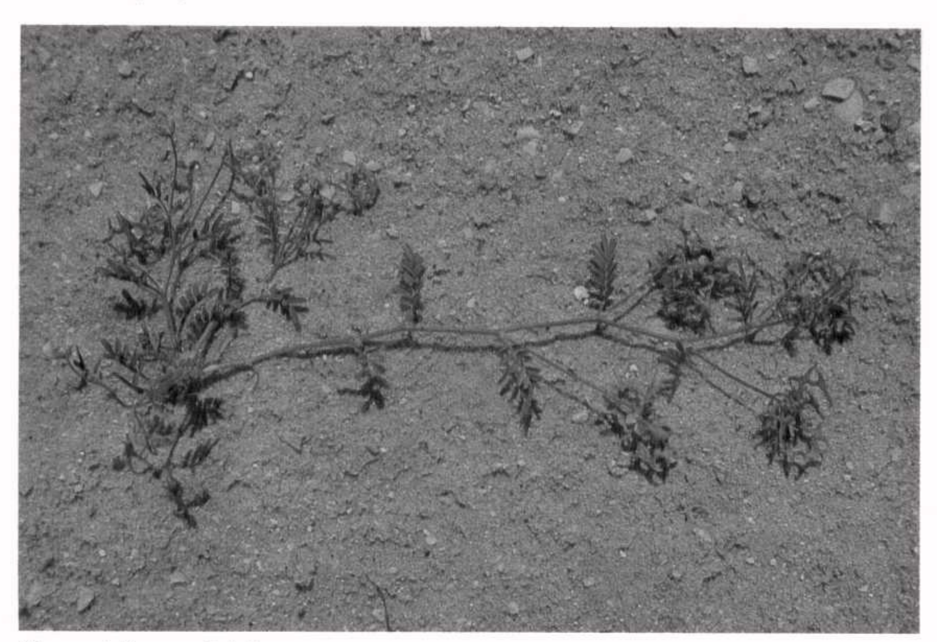
Astragalus tribuloides Del.



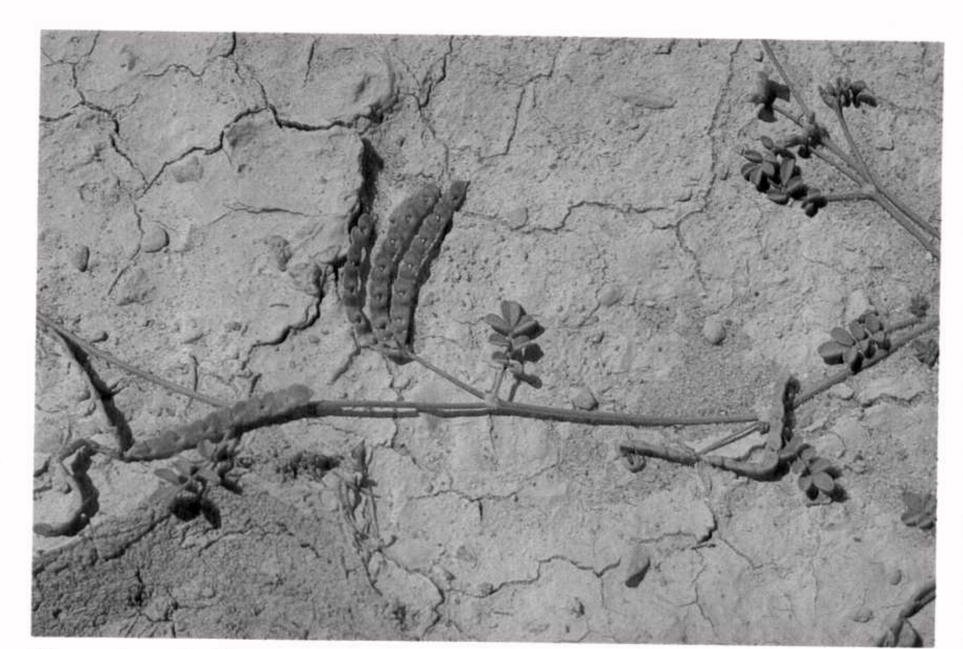
Astragalus tribuloides Del.



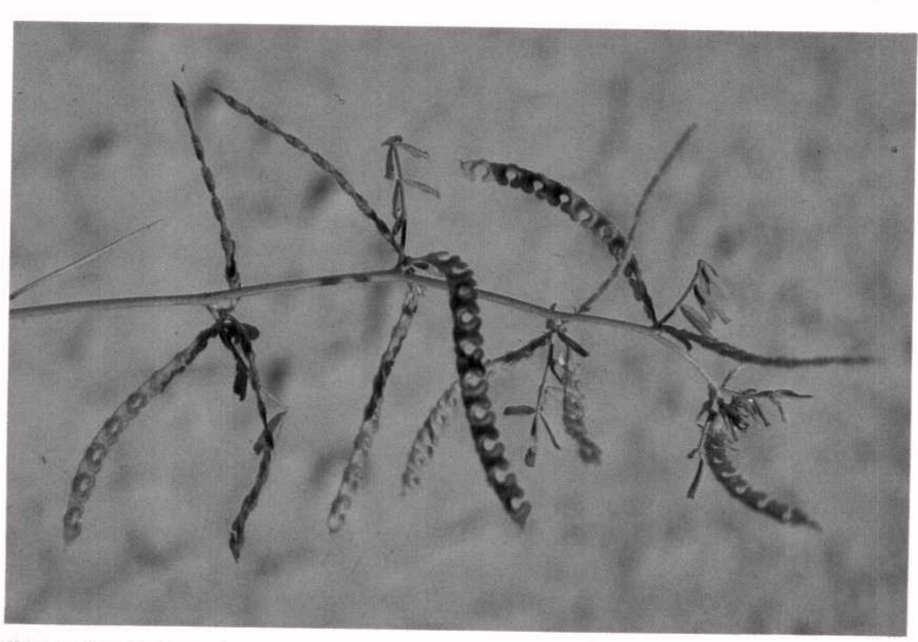
Cassia italica (Mill.) Lam. ex Andrews.



Hippocrepis bicontorta Loisel.



Hippocrepis constricta Kuntze.

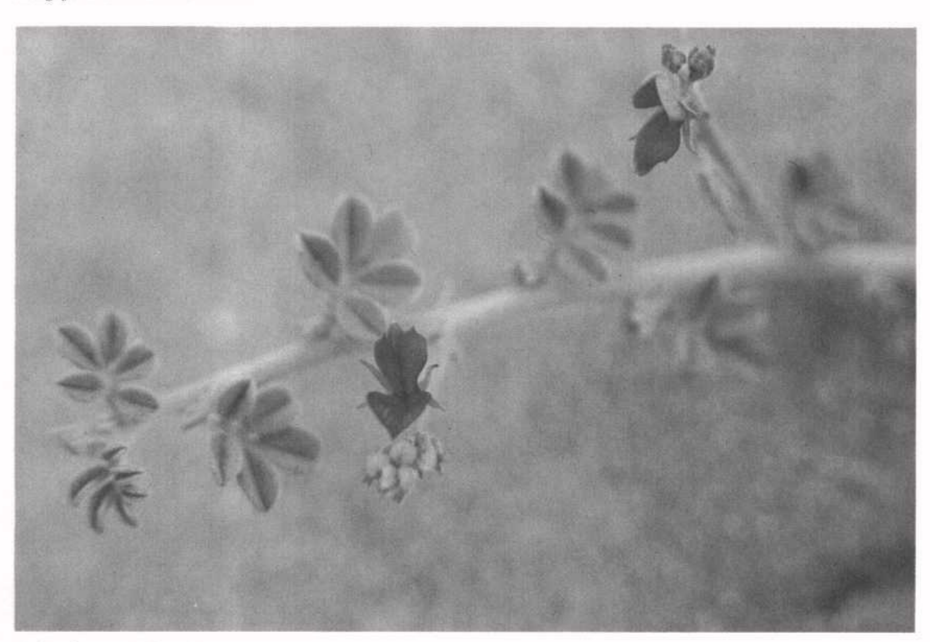


Hippocrepis multisiliquosa L.

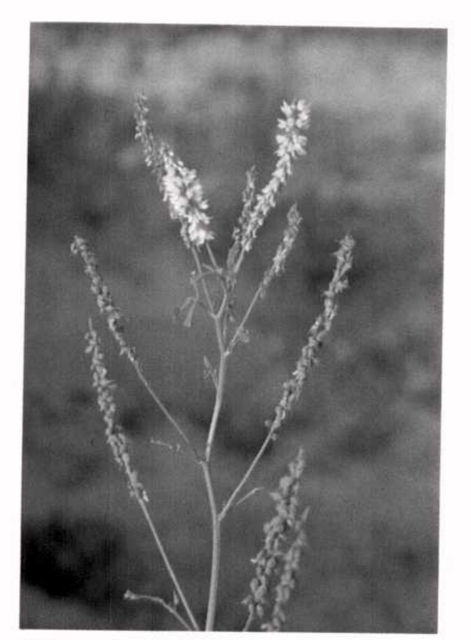
PLATE 48



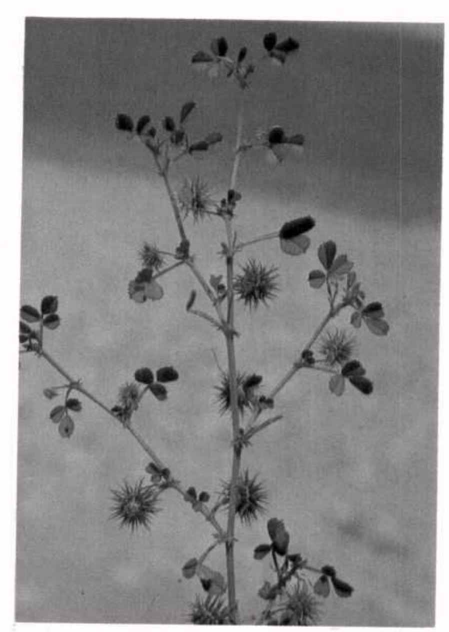
Indigofera articulata Gouan.



Indigofera articulata Gouan.



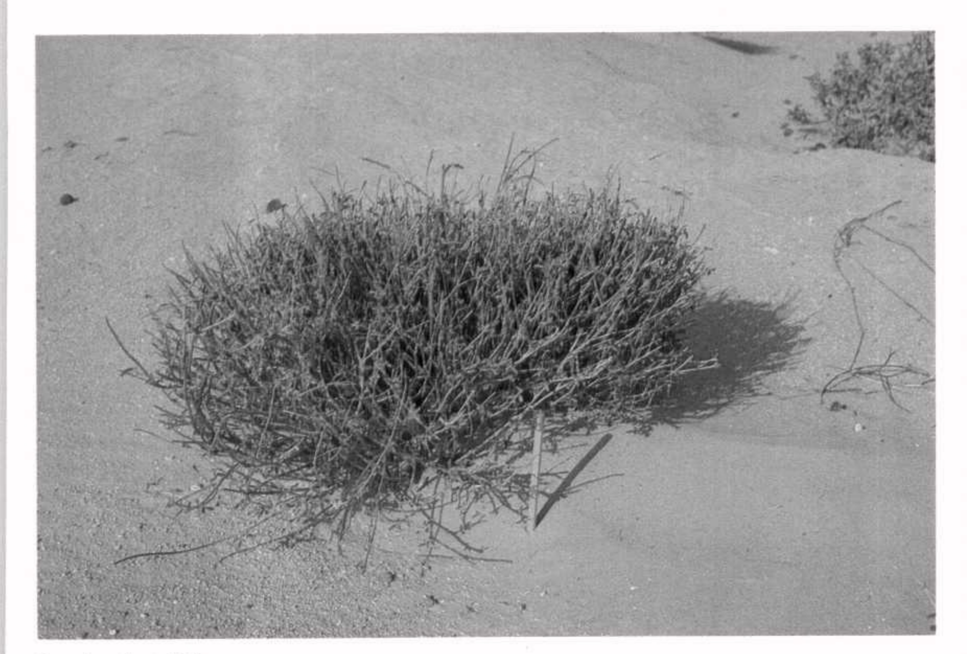
Melilotus albus Medik. ex Desr.



Medicago laciniata (L.) Mill.



Medicago sativa L.



Psoralea plicata Del.



Psoralea plicata Del.

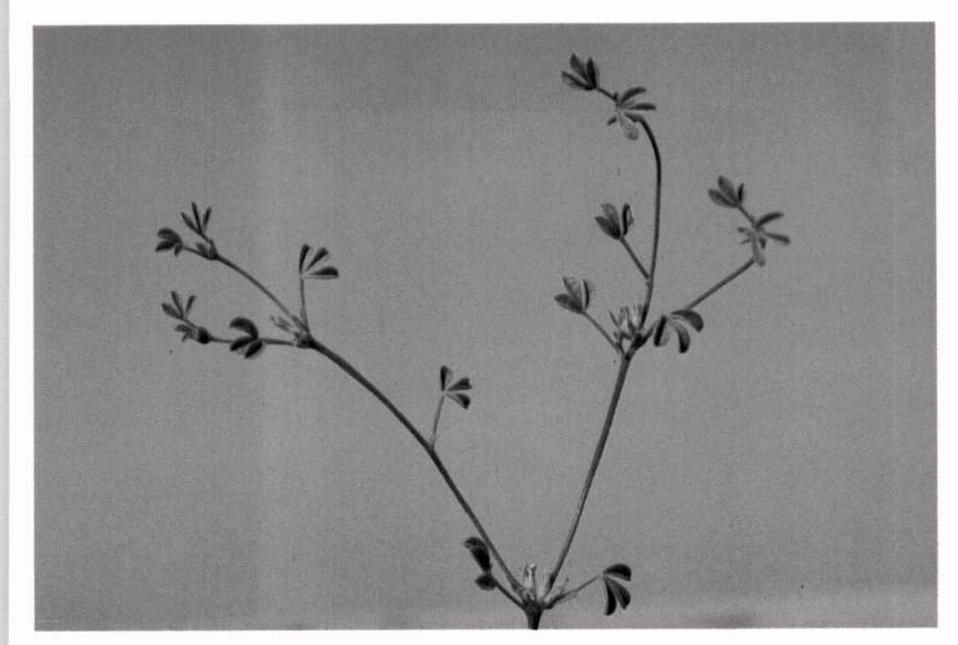


Scorpiurus muricatus L.

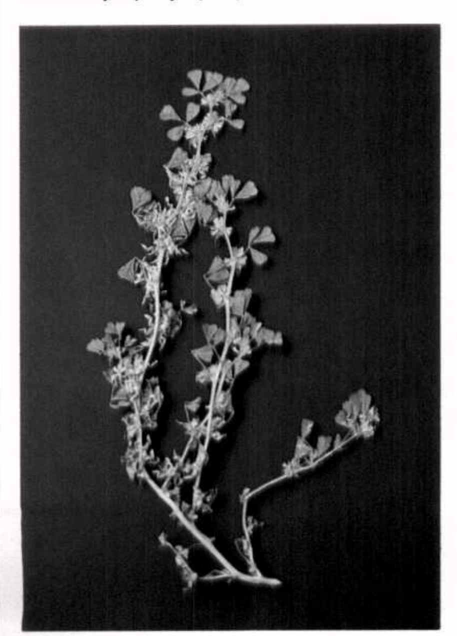


Taverniera aegyptiaca Boiss.

PLATE 52



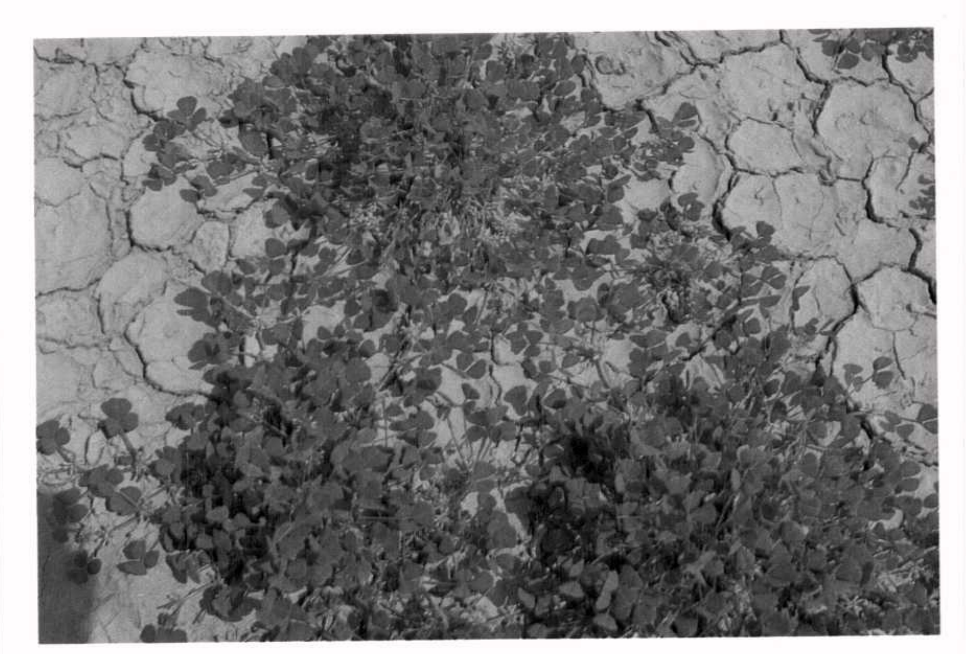
Lotononis platycarpa (Viv.) Pichi-Sermoli.



Trigonella anguina Del.



Trigonella hamosa L.



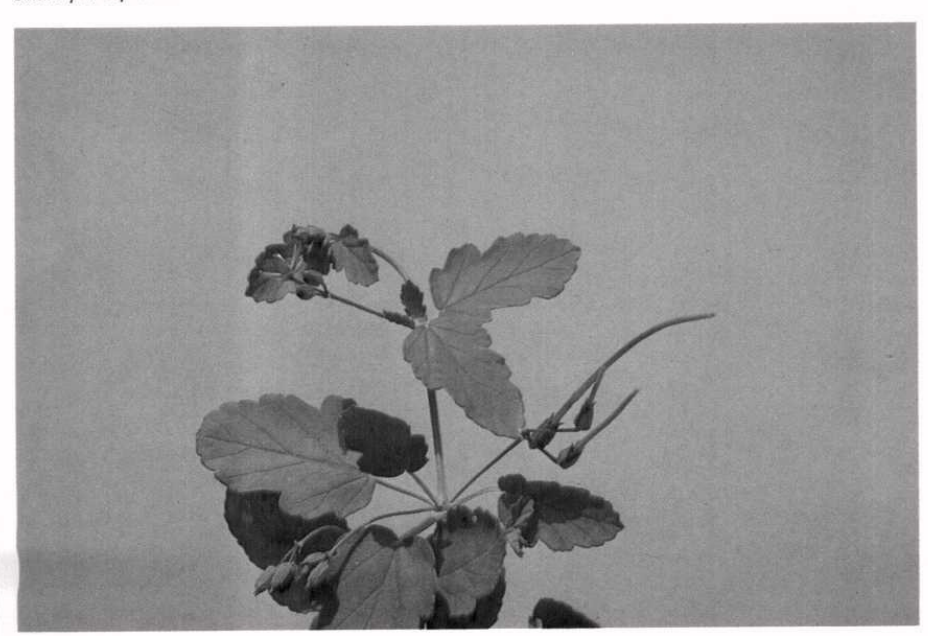
Trigonella stellata Forssk.



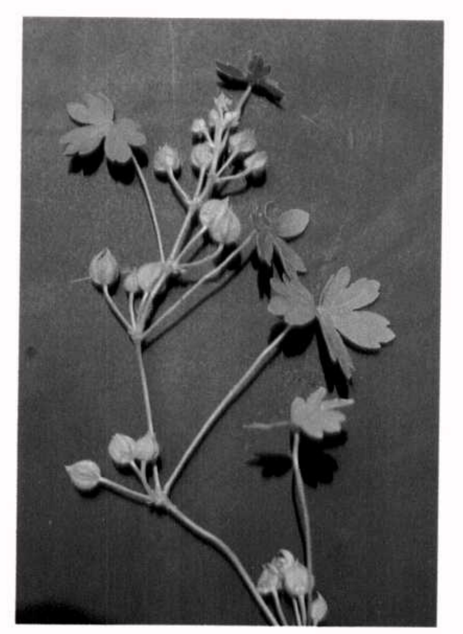
Trigonella stellata Forssk.



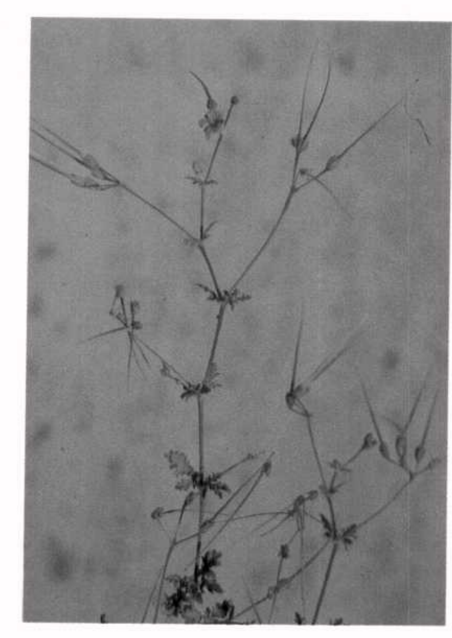
Oxalis pes-caprae L.



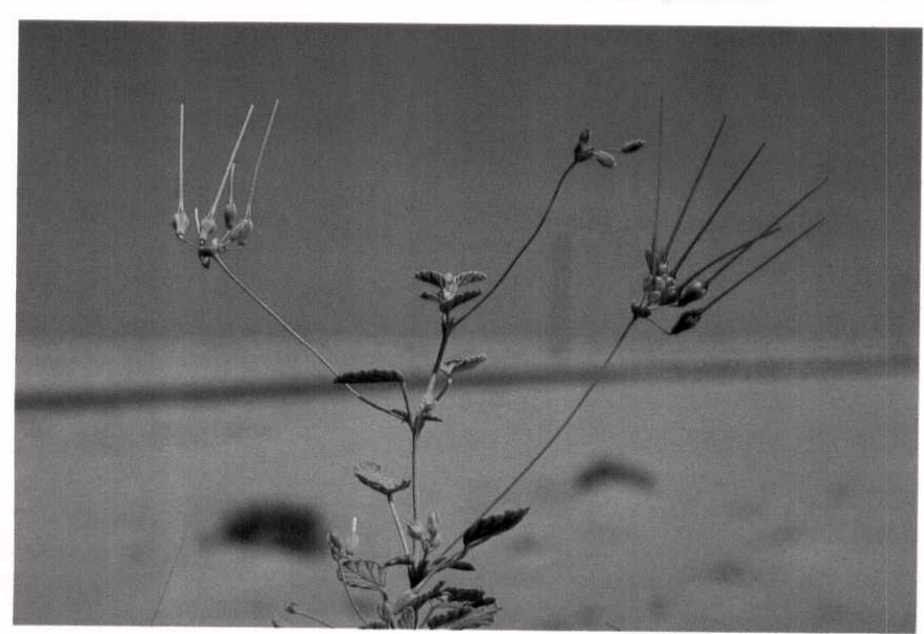
Erodium glaucophyllum (L.) L'Her.



Geranium molle L.



Erodium laciniatum (Cav.) Willd.



Monsonia heliotropioides (Cav.) Boiss.

1. Pedicels as long as the calyx or shorter. Calyx hispid. Beak of mericarp 7–9 cm. Leaves ovate–cordate . . . . 1. *M. heliotropioides*
2. Pedicels 3–4 times as long as the calyx. Calyx appressed–tomentose. Beak of mericarp 4–5 cm. Leaves ovate–oblong . . . . 2. *M. nivea*

1. *Monsonia heliotropioides* *(Cav.) Bois.*, Fl. Orient. 1: 897 (1867; orrh. err. 'heliotropoides'); Zohary, Fl. Palaest. 2: 244, t. 351 (1972); Täckh., Stud. Egypt, ed. 2, 300 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 133 (1978). *Geranium heliotropioides* Cav., Monad. Class. Dissert. 220, t. 113, f. 1 (1787).

Perennial, erect, 25–40 cm tall, of greyish-green colour with well-developed stem, leafy in the lower half. Leaves opposite, long-petioled; blade ovate–cordate, the length of the blade at least twice or more its breadth. Peduncles stiff, long, 8–12-flowered. Pedicels shorter than to as long as the calyx. Petals as long as sepals or shorter, pink. Fruit beak 7–9 cm, plumose.

The plant is common in sourthern and western Qatar on sandy soil. Flowering from February to May (Plate 56).

2. *Monsonia nivea* *(Decne) Decne ex Webb*, Fragm. Florul. Aethiop.-Aeg. 59 (1854); Zohary, Fl. Palaest. 2: 244, t. 350 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 300 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 133 (1978).

Erodium niveum Decne, Ann. Sci. Nat. Bot. Ser. 2, 3: 285 (1835).

Small, silvery canescent perennial herb, 15–25 cm. Stems very short, procumbent, rarely branched. Leaves rosetted; bladle ovate–oblong with deeply impressed nerves. Peduncles very long, 2–6-flowered arising from the rosette. Pedicels 1–2·5 cm. Sepals 4–6 mm. Petals slightly longer than sepals, pink. Fruit beak 4–5 cm long, plumose.

The plant is very common in sandy habitats in southern Qatar. Flowering from March to May.

20. *ZYGOPHYLLACEAE R. BR.*

Shrubs or herbs, branches often jointed at the nodes. Xerophytes or halophytes. Leaves opposite, 2-foliate or pinnate or trifoliate, stipulate. Flowers bixexual, actinomorphic. Sepals 5, free or connate at the base. Petals 5, free or absent. Stamens often unequal in length, 8–15 with ligular appendages at base. Ovary superior, 4- to 5-loculed. Ovules 1 or more in each locule. Fruit various.

I. Stipules transformed into spines . . . . 1. *Fagonia*
II. Stipules not spiny.
  A. Fruit spiny or tubercled, leaves pinnate . . . . . 3. *Tribulus*
  B. Fruit unarmed.
    1. Leaves flattened, 3-foliate. Petals absent. . . . 2. *Seetzenia*
    2. Leaves terete, if flattened 2-foliate. Petals present 4. *Zygophyllum*

1. *FAGONIA L.*

Much-branched annual herbs, or perennials woody at the base, pubescent or glabrous.

Leaves often opposite, tri- or unifoliate; leaflets entire, mucronate. Stipules conspicuous, usually spiny. Flowers solitary, rose to violet, rarely yellowish, pentamerous. Sepals deciduous or persistent. Petals 5, clawed, caducous. Stamens 10, without appendages. Ovary 5-locular, with 2 ovules in each locule. Fruit a pyramidal, 5-carpelled capsule, splitting from below into 5 cocci. Seeds flat, oblong, with faveolate–punctate testa.

I. All leaves unifoliate.
  A. Calyx deciduous; leaves ovate . . . . 4. *F. ovalifolia*
  B. Calyx persistent; leaves lanceolate . . . . 3. *F. indica*
II. All leaves trifoliate . . . . 2. *F. glutinosa*
III. Lower leaves tri-, upper unifoliate spines longer than leaves . 1. *F. bruguieri*

11. *Fagonia bruguieri* *DC.* Prodr. 1: 704 (1824); Boiss., Fl. Orient. 1: 905 (1867); Carter, Rec. Bot. Surv. Ind. 6, 6: 194 (1977); Burtt et Lewis, Kew Bull. 3: 394 (1954); Rech., Fl. Lowland Iraq 404 (1964); Zohary, Fl. Palaest. 2: 250, t. 359 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 303 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 139 (1978).

Perennial with woody base, pale green, glandular hairy or glabrous. Stems many, much branched, procumbent; branches with very short joints, with 3 strong ridges at angles, deeply sulcate between. Stipular spines spreading, slender, 1–2 cm long, mostly longer than the leaves, slightly curved. Leaves short-petioled, the lower ones trifoliate, upper unifoliate; leaflets oblong–linear, mucronulate. Flowers small, 8 mm across. Pedicels shorter than the capsule, erect at first, later horizontal or slightly deflexed. Sepals 2–3 mm, persistent. Petals pink, 2–3 times as long as sepals, pink. Capsule up to 4 mm, obconical, hairy; calyx persistent.

This species is represented in Qatar by 3 varieties, *viz.* var. ***bruguieri***, var. ***rechingeri*** Hadidi and var. ***laxa*** Boiss.

2. *Fagonia glutinosa* *Del.*, Fl. aegypt. Ill. 230, 86, t. 28, f. 2 (1813); Boiss., Fl. Orient. 1: 904 (1867); Burtt et Lewis, Kew Bull., 1954, 3: 394 (1954); Rech., Fl. Lowland Iraq 403 (1964); Zohary, Fl. Palaest. 2: 248 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 306, t. 98 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 139 (1978).

Perennial, pale green prostrate herb, entirely covered with stalked viscid glands with adherent sand. Internodes long, slender, terete and striate. leaves short-petioled, 3-foliate, the leaflets obtuse, the intermediate leaflet ovate–rhombic or obovate, 5–8 mm long, the lateral ones smaller. Stipular spines spreading, short, about 3–4 mm long, of unequal length, shorter than the leaves. Flowers small, 8 mm across. Sepals ovate–oblong. Petals pale pink, twice as long as the sepals. Peduncles erect or patent, 3–4 mm long, shorter than the capsule. Capsule glandular sticky, about 5–6 mm broad. Calyx persistent.

Rare in Qatar; it has been recorded only in southern Qatar in sandy habitats. Flowering from March to April (Plate 57).

3. *Fagonia indica* *Burm.* f., Fl. Ind. 102, t. 34, fig. 1 (1768); Täckh., Stud. Fl. Egypt, ed. 2, 304, t. 97 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 140, t. 145 (1978).

F. parviflora Boiss., Diagn. Pl. Or. Nov. Ser. 1, 8: 124 (1849) et Fl. Orient. 1: 908 (1867); Rech., Fl. Lowland Iraq 405 (1964).

Perennial, pale green, almost glabrous plant, only juvenile parts frequently pruinose and glandular. Stems prostrate or ascending, nearly terete in cross-section. Leaves

shorkt-petioled, simple, oblong–linear, mucronulate. Stipular spines spreading, slender, about 1·5–2 cm long of unequal length. Flowers up to 12 mm across. Sepals lanceolate. Petals pale, pink, twice as long as the sepals. Peduncle 8–10 mm long, reflexed, twice as long as the capsule. Capsule about 4 mm long, minutely pubescent. Calyx persistent.

This species is represented in Qatar by var. *indica*. Occasional plant in sandy habitats. Flowering from March to May (Plate 57).

4. *Fagonia ovalifolia* *Hadidi*., in Rech., Fl. 98: 2 (1972).

Annual or biennial, procumbent herb. Leaves simple, on 5 mm long petiole; blade 15 × 18–10 mm, broad ovate, mucronate, with distinct nerves. Spines patent, 5–15 mm long. flowers 8 mm across, on short pedicels. Sepals 3 × 1·5 mm, ovate, glandular. Petals 5 × 2 mm, rose coloured. Stamens 10, filaments 4 mm long. Capsule *ca.* 4 × 5 mm, pendulous on reflexed pedicels. Calyx deciduous.

This plant is common in Qatar, especially in sandy habitats. It is represented in Qatar by 2 varieties: var. ***ovalifolia*** and var. ***pakistanica***. Flowering in the spring (Plates 58, 59).

2. *SEETZENIA* R. BR.

Perennial, prostrate herbs with 3-foliate, opposite, stipulate leaves. Flowers minute in the leaf axils, bisexual. Sepals 5, persistent. Petals absent. Disc 5-lobed. Stamens 5, inserted on the disc. Filaments without appendage at base. Ovary sessile, 5-loculed. Style 5, free, deflexed. Capsule ovoid, 5-angled, separable into 5 one-seeded carpels. The fleshy sepals persisting as 5 green stripes around the yellow capsule.

1. *Seetzenia orientalis* *Decne*, Ann. Sci. Nat. Bot. Ser. 2, 3: 281, t. 7 (1835); Boiss., Fl. Orient. 1: 916 (1867); Burtt et Lewis, Kew Bull. 1954, 3: 397 (1954); Rech., Fl. Lowland Iraq 405 (1964); Zohary, Fl. Palaest. 2: 247, t. 354 (1972).

S. lanata (Willd.) Bullock, Kew Bull. 19: 204 (1965); Täckh., Stud. Fl. Egypt, ed 2, 307 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 151 (1978).

Glabrous perennial prostrate herb. Leaves fleshy, petiolate, trifoliate; stipules membranous, reflexed, triangular, ciliate; leaflets obovate–cuneate, mucronate, the lateral leaflets oblique, smaller than the middle one. Peduncles solitary, longer than the subtending leaves. Sepals 3 mm, persistent, elongating in fruit, somewhat fleshy. Petals 0. Stamens 5. Capsule 8 × 5 mm, ellipsoid to ovoid; yellow glossy.

Rare in Qatar. The plant grows in sandy habitats in southern Qatar. Flowering from February to March (Plate 60).

3. *TRIBULUS* L.

Annual or perennial, prostrate, hairy herbs. Leaves opposite, pinnate. Flowers regular, solitary in the forks of branches or in the leaf axils. Sepals 5, persistent or caducous. Petals 5. Stamens 5 or 10 inserted at base of the annular disc. Ovary sessile, 5–5-loculed. Fruit dry, splitting into 4 or 5 indehiscent bony fruitlets bearing spines, wings or tubercles.

I. Carpels with hairy dentate wings . . . 1. *T. arabicus*
II. Carpels with spines . . . . . 2. *T. terestris*

1. *Tribulus arabicus* *H. Hosni*, Bot. Notiser. 130: 261–262 (1977).

Perennial herb; densely hairy, greyish-green. Leaves palripinnate, 0·8–3·5 cm long. Leaflets 4–7 pairs. Flowers large, on 15 mm long pedicels. Sepals 5, *ca.* 7 mm long. Petals yellow, 15 mm long. Stamens 10. Stigma slender, 3 mm long. Fruit elliptic, 9 mm long, 7 mm broad, densely hirsute. Carpels 9 mm long, with two marginal wings 2·5 mm broad.

Rare in Qatar, on shallow fine-textured soil and pebbly habitats. First recorded by Obeid (1975). This species is known from Saudi Arabia, Yemen, Democratic Republic of Yemen, Oman and Qatar. (Hosni, Bot. Notiser. 130: 261–262 (1977).)

2. *Tribulus terrestris* *L.*, Sp. Plant., ed. 1. 387 (1753); Boiss., Fl. Orient. 1: 902 (1867); Burtt et Lewis, Kew Bull. 1954, 3: 398 (1954); Rech., Fl. Lowland Iraq 407 (1964); Zohary, Fl. Palaest. 2: 256, t. 370 (1972); Täckh., Stud. Fl. Egypt., ed. 2, 131, t. 100 (1974); Migahid, Fl. Saudi Arab., ed. 2. 1: 141 (1978).

Annual or biennial, prostrate, pubescent or silky canescent. Leaves imparipinnate, 4–8 cm, mostly in pairs, the smaller leaf with 5 pairs of leaflets, the larger with 6–8 pairs; stipules 4 mm, lanceolate. Flowers arising at the nodes of the sympodicel stem axis, with pedicels much shorter than the leaves. Sepals 5, about 5 mm long, lanceolate. Petals up to twice as long as sepals, yellow, oblong-linear. Stamens 10. Stigma subsessile, mostly pyramidal. Mericarps about 1 cm across, appressed hairy or canescent, with 4 very strong prickles, the lower ones sometimes abortive, very rarely all reduced to conical tubercles.

Occasional plant in Qatar. It grows in pebbly habitats with shallow, fine, surface deposits. Flowering from April to June. Specimens have been recorded flowering in November. Local name: *Gatha* is a name given by Carter and Muschler (cf. Carter, 1917) (Plate 60).

4. *ZYGOPHYLLUM* L.

Perennial herbs or shrubs or annuals, with stipulate, fleshy, opposite leaves. leaves mostly 2-foliate, rarely simple, cylindrical or ovoid, rarely flattened. Flowers white, pinkish or yellow, solitary or paired, axillary. Sepals 4–5. Petals 4–5, clawed, imbricate in bud. Disc fleshy. Stamens 8–10, inserted at base of disc, furnished with a scale at base. ovary sessile, angular, 4–5-loculed, tapering into a style. Ovules 2 or more in each locule. Fruit oblong; cylindrical, angular or winged.

I. Undershrubs; leaves 2-foliate, sometimes unifoliate, leaflets clavate or obconical . . . . 1. *Z. quatarense*
II. Annual herbs; leaves simple, leaflets cylindrical . . . . 2. *Z. simplex*

1. *Zygophyllum quatarense* *Hadidi*, in Boul., Webb. 32, 2: 394 (1978).

Shrublet up to 50 cm high. Branches ascending or spreading, old branches woody, younger branches purple, internodes slender, pubescent. Leaves 2-foliate, older ones unifoliate; leaflets pubescent, clavate or obconical, 4–7 mm long; petiole cylindrical as long as leaflets; stipules triangular, membranous. Flowers solitary at each node, peduncle obconical, 2–3 mm long. Sepals ovate, glandular. Petals 5, narrow spathulate, yellowish-green. Stamens 10. Ovary conical, glabrous; style and stigma simple. Capsule obconical, 3 × 8 mm, glabrous, 5-angled; carpels keeled, peduncle slender, 2–3 mm long.

Very common plant in Qatar. It grows in rocky habitats with thin veneer of surface

deposits, also in slightly saline habitats. Flowering from March to April. Local name: *Harm* (Plate 61).

2. ***Zygophyllum simplex*** *L.*, Mant. 68 (1767); Boiss., Fl. Orient. 1: 912 (1867); Burtt et Lewis, Kew Bull. 1954, 3: 400 (1954); Zohary, Fl. Palaest. 2: 252, t. 367 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 309, t. 99 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 151 (1978).

Annual, glabrous matty-prostrate succulent herb. Leaves simple, 0·8–2 cm, fleshy, cylindrical; stipules membranous, lanceolate, acute. Peldicels shorter than the calyx, elongating in fruit and becoming deflexed. Flowers axillary, solitary or in pairs, scattered along the branches. Sepals 5, about 2 mm, caducous, very broadly scarious-margined. Petals longer than sepals, yellow, spathulate, long-clawed. Capsule 2–2·5 mm, obovoid–globular to turbinate, with 5 prominent, narrowly winged wrinkled carpels.

Very common in Qatar. The plant grows in rocky and pebbly habitats. Flowering from March to June. Local name: *Girm*. This species may perennate till the second year (Plate 62).

21. *EUPHORBIACEAE* *A. JUSS.*

Plants of various aspect, with acrid, milky, or colourless juice. Leaves usually alternate, rarely opposite or whorled, mostly stipulate. Flowers small, mostly unisexual, actinomorphic, arranged in axillary or terminal racemose or cymose inflorescences. Staminate flowers with intrastaminal disc or disc lobes or glands alternating with outer stamens; stamens few or many, sometimes 1. Pistillate flowers with a free, superior, 3-celled ovary. Fruit usually a capsule separating from a persistent central column into 3 cocci.

I. Flowers arranged in cyathia, each cyathium consisting of a cup-shaped involucre containing numerous staminate flowers (each of 1 stamen) around a solitary pistillate flower of but a stalked ovary. Plants with acrid, milky juice . . . . 3. *Euphorbia*
II. Flowers otherwise. Plants without milky juice.
  1. Dioecious plants. Leaves opposite. Staminate flowers clustered in catkins borne on axillary or terminal peduncles; pistillate flowers 1–2 together, axillary, subsessile . . . . 4. *Mercurialis*
  2. Monoecious plants. Leaves alternate.
    a. Shrubs or small tree, with palmate 7–11 lobed leaves, capsule prickly, 1–3 cm . . . . 5. *Ricinus*
    b. Herbs, or low shrubs, leaves entire or slightly lobed. Capsule small, not prickly
      x. Leaves up to 1 cm . . . . 1. *Andrachne*
      xx. Leaves 2–9 cm or more . . . . 2. *Chrozophora*

1. *ANDRACHNE* *L.*

Delicate, prostrate plants with shrubby base. Leaves alternate, mostly petiolate, simple. Flowers small, axillary. Flowers unisexual; calyx deeply 5-parted. Petals minute or absent. Fruit a 3-loculed capsule with 2 seeds in each cell.

1. ***Andrachne telephioides*** *L.*, Sp. Plant., ed. 1, 1014 (1753); Boiss., Fl. Orient. 4: 1138

(1879); Schiman–Czeika in Rech., Fl. Lowland Iraq 413 (1964); Zohary, Fl. Palaest. 2: 265, t. 382 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 319 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 165 (1978).

Perennial, glabrous, prostrate plant, branched from base. Leaves 0·4–1 cm, alternate, petiolate, obovate with tapering base, acute. Flowers in 1–3 in an axil, pedicellate. Sepals 2–3 mm. Petals shorter than sepals, yellowish. Capsule 3–4 mm, glabrous.

Common in Qatar in stony and gravelly habitats. Flowering from March to June (Plate 63).

2. *CHROZOPHORA NECK.*

Herbs or undershrubs covered with stellate hairs. Leaves alternate, stipulate. Flowers in spike-like racemes, upwards numerous sessile male flowers, below a few pedicelled female flowers. Staminate flowers: petals 5, alternate with the sepals. Stamens 5–15, in 1–3 whorls. Pistillate flowers: petals 5, sometimes 0. Staminodes 5 or 0. Ovary globular, 3-celled, cells 1-ovuled. Capsule ovate–globular.

1. *Chrozophora verbascifolia* *(Willd.) A. Juss.* Euph. Gen. Ten. 28 (1824); Boiss., Fl. Orient. 4: 1141 (1879); Zohary, Pal. Journ. Bot. 1, 3: 253 (1939) et Fl. Palaest. 2: 267 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 316 (1974).

C. hierossolymitana Spreng., Syst. Veg. 3: 850 (1826); Blatter, Journ. Ind. Bot. Soc. 11: 42 (1932); Rech., Fl. Lowland Iraq 414 (1964); Halwagy et Macksad, Bot. J. Linn. Soc. 54: 74 (1972).

Annual, about 30–50 cm high, densely white-panous. Stems erect, diverticately branched. Leaves long-petiodled; ovate–lanceolate, 3–8 cm long, acutish or obtuse, longer than broad. Sepals and petals linear–lanceolate.

In cultivated *rodat* along field margins and waste places. It has been collected from Al-Wabrah in September; the material was fruiting and a great part of the vegetative growth was dry.

3. *EUPHORBIA L.*

Monoecious shrubs or herbs (ours) with acrid milky juice. Flowers borne in a cyathium, which consists of a cup-shaped involucre including several male flowers and a single central female flower. Male flowers consist of but 1 stamen, the female of a 3-loculed ovary. The involucre consists of 4–5 free or adnate lobes. Its margin bears 4–5 nectariferous glands with or without marginal appendages.

I. Mostly prostrate plants with opposite asymmetric and stipuled leaves.
- A. Blade over 15 mm long and 10 mm broad.
  - 1. Leaves lanceolate, acute; cyathia in globose heads . . . 3. *E. hirta*
  - 2. Leaves elliptic or ovate, rounded, cyathia in peduncled cymes 4. *E. hypericifolia*
- B. Blade smaller.
  - 1. Capsule hairy.
    - a. Leaves glabrous above, thinly pubescent beneath . . . 1. *E. granulata* var. *glabrata*
    - b. Leaves hairy on both surfaces . . . . 2. *E. granulata*

2. Capsule hairy along keel only . . . . 6. *E. prostrata*
3. Capsule glabrous . . . . 7. *E. granulata* var. *turcomanica*

II. Mostly erect or ascending plants, at least lower leaves symmetrical, exstipulate.
A. Cyathia in clusters; each cyathium short-pedicelled, pedicels shorter than cyathium, floral, bracts red at base . . . . . 2. *E. heterophylla*
B. Cyathia in umbels; pedicels longer than cyathium.
1. Leaves serrate . . . . 7. *E. retusa*
2. Leaves entire . . . . 5. *E. peplus*

1. *Euphorbia granulata* *Forssk.*, Fl. Aegypt.-Arab. 94 (1775); Boiss., Fl. Orient. 4: 1087 (1879); Rech., Fl. Lowland Iraq 418 (1964); Halwagy et Macksed, Bot. Journ. Linn. Soc. 65: 74 (1972); Zohary, Fl. Palaest. 2: 273, t. 391 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 326 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 153 (1978).

Prostrate annual (sometimes biennial) herb, greyish velvety. Stems many, arising from base, prostrate, brittle. Leaves opposite, petiolate, obovate to elliptical, oblique at base, entire; stipules minute. Cyathia in axillary racemes, subsessile. Capsule 1·5 mm in diameter, obovoid, hirsute or glabrous. Seeds oblong-tetragonous, transversely wrinkled-pitted.

In addition to the type, the species is represented also by 2 varieties, viz. var. ***glabrata*** Boiss. in DC., Prodr. 15, 2: 34 (1862) et Fl. Orient. 4: 1087 (1879), with internodes longer than in type, giving the plant a lax appearance; leaves and capsules thinly pubescent, and var. ***turcomanica*** (Boiss.) Hadidi, Bull. Jard. Bot. Nat. Belg. 43: 83–100 (1973), with frutescent prostrate branches and short internodes; leaves and capsules sparingly hairy.

The plant is common in Qatar in sandy and gravelly habitats. Flowering from February to March (Plate 63).

2. *Euphorbia heterophylla* *L.*, Sp. Plant. ed. 1, 458 (1753); Täckh., Stud. Fl. Egypt, ed. 2, 326 (1974).

E. cyathophora Murr. in Comm. Gotting. 7: 81 (1786).

Erect annual herb up to 60 cm high; stems simple or rarely branched, glabrous; internodes shortening towards the apex, the lower leaves often opposite and falling early, and the upper ones alternate and forming an open rosette around the terminal inflorescences. Leaves elliptic, acute to acuminate at the apex, cuneate to acute at the base, up to 10 cm long, 5 cm broad. Floral bracts red at base. Cymes densely corymbose, gland flesh-coloured. Capsule glabrous. Seeds blackish, finely tubercled, not angular.

A variable species of American origin. It is rarely cultivated in Qatar and naturalized in cultivated land. The plant is common in Al-Wabrah where it is naturalized (Plate 63).

3. *Euphorbia hirta* *L.*, Sp. Plant, ed. 1, 454 (1753); Zohary, Fl. Palaest. 2: 274, t. 395 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 323 (1974); Batanouny et Baeshin, Täckholmia, 9: 75 (1979).

E. pilulifera L., l.c. p.p.; Hook, Fl. Brit. Ind. 5: 250 (1887); Rech., Fl. Lowland Iraq 418 (1964).

Annual villous herb, with erect or decumbent branches. Leaves 1·5 × 1–2 cm, opposite, short-petioled, lanceolate, acute, finely serrate. Stipules 1–2 mm, membranous.

Inflorescence capitate, about 1 cm in diameter, axillary, pedunculate, dense, composed of staminate and hermaphrodite, cyathia. Cyathia 1–2 mm. Capsule about 2 mm, globular, adpressed-hirsute. Seeds 1 mm, tetragonous, irregularly transversely wrinkled.

Rare in Qatar as weed in cultivated land. Flowering from April to August.

4. ***Euphorbia hypericifolia*** *L.*, Sp. Plant., ed. 1, 454 (1753); Täckh., Stud. Fl. Egypt, ed. 2, 323, t. 110 (1974).

E. indica Lam., Enc. Méth., Bot. 2: 423 (1788); Rech., Fl. Lowland Iraq 417 (1964).

Annual, glabrous to puberulous herb, with erect or ascending branches. Leaves opposite, short-petioled, elliptic to ovate, rounded, remotely serrulate. Stipules setaceous. Cyathia in axillary peduncled cymes. Capsule adpressed-hirsute, with keeled carpels. Seeds with reticulate furrows.

Occasional weed in Doha gardens. Flowering from March to April.

5. ***Euphorbia peplus*** *L.*, Sp. Plant., ed. 1, 456 (1753); Rech., Fl. Lowland Iraq 422 (1964); Zohary, Fl. Palaest. 2: 283 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 332 (1974).

Erect annual glabrous, bright green herb. Leaves thin, alternate or subopposite, obovate to orbicular, obtuse, entire. Umbels terminal, rays 3, several times forked. Capsule glabrous, capsule with 2 wing-like keels. Seeds 1·5–2 mm long, prismatic–ovoid, hexagonal in transverse section, each of the 4 dorsal–lateral faces furnished with a row of 3–5 pit-like furrows, the 2 ventral–lateral faces with a characteristic longitudinal furrow.

Very rare in Qatar; weed in cultivated land. Flowering from February to March (Plate 64).

6. ***Euphorbia prostrata*** *Ait.*, Hort. Kew. 2: 139 (1789); Zohary, Fl. Palaest. 2: 274, t. 395 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 326 (1974).

Prostrate dark green, glabrous or slightly pubescent annual herb. Leaves 0·3–0·8 cm, almost all alike, opposite, short-petioled, oblong to elliptic, obtuse, entire, obscurely serrulate at apex, reddish, absolutely 3-nerved. Stipules minute. Cyathia axillary mostly solitary, 1 mm across. Capsule 1–1·5 mm, ovoid, sharply trigonous, pubescent, with spreading hairs along the acute angles. Seeds about 1 mm, quadrangular, whitish.

Very common weed in Qatar. It grows in irrigated localities. Flowering from April to November (Plate 64).

7. ***Euphorbia retusa*** *Forssk.*, Fl. Aegypt.-Arab. 93 (1775), t. 13 (1776); Rech., Fl. Lowland Iraq 419 (1964); Zohary, Fl. Palaest. 2: 276, t. 400 (1972) Täckh., Stud. Fl. Egypt, ed. 2, 330, t. 108 (1974) Migahid, Fl. Saudi Arab., ed. 2, 1: 153, t. 163 (1978).

E. kahirensis Raeusch., Nom., ed. 3, 140 (1797) subs. illegit. *E. cornuta* Pers., Syn. Pl. 2: 17 (1806) subs. illegit; Boiss., Fl. Orient. 4: 1093 (1879).

Annual, sometimes perennial, glabrous herb. Stems erect to ascending, branched from base. Leaves 1–3 cm, sessile. Cauline leaves linear to oblong, rounded or somewhat clasping at base, retuse or acute at apex, acutely serrate, umbellar and floral leaves opposite, cordate and dilated at base, caudate–acuminate and usually recurved at tip, much more serrate than the cauline leaves. Inflorescence a repeatedly forked umbel. Cyathia about 3 mm, pedicellate. Capsule 5–6 mm, ovoid, smooth. Seeds about 2·5 mm, smooth, with yellowish caruncle about 1 mm.

Rare in Qatar; it grows in sandy habitats. Flowering from February to April.

4. *MERCURIALIS L.*

Herbs with opposite, stipulate, simple leaves. Male flowers in long, narrow, loose spikes or catkins. Female flowers axillary, solitary in clusters, subsessile or pedunculate. Petals absent. Fruit a dehiscent capsule.

1. ***Mercurialis annua*** *L.*, Sp. Plant., ed. 1, 1035 (1753); Boiss, Fl. Orient. 4: 1142 (1879); Zohary, Fl. Palaest. 2: 268, 388 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 318 (1974).

Dioecious annual, 20–50 cm. Stems erect, branched striate, thickened at nodes. Leaves 1·5–6 cm, petiolate, opposite, ovate to lanceolate, crenate–serrate. Flowers 3–5 mm across, green. Male flowers clustered in catkins borne on axillary and terminal peduncles much longer than the leaves. Perianth 3 sepaloid segments. Female flowers axillary, solitary. Capsule 3–4 mm compressed ovoid, covered with tubercles which terminate in bristles.

5. *RICINUS L.*

Monoecious shrubs with alternate, stipulate, palmately lobed leaves. Flowers above, female flowers below. Petals absent. Male flowers with numerous stamens connate and branched repeatedly. Female flowers with a large 3-loculed ovary. Fruit a trilocular capsule covered with prickles.

1. ***Ricinus commuris*** *L.*, Sp. Plant., ed. 1, 1007 (1753); Boiss., Fl. Orient. 4: 1143 (1879); Zohary, Fl. Palaest. 2: 269, t. 389 (1972).

Glabrous shrub with hollow stems. Leaf blade 7–11-lobed. Flowers axillary and in terminal racemes. Male flowers with numerous stamens. Capsule 1–3 cm, covered with prickles. Seeds about 1 cm, often mottled.

The plant is usually cultivated in hedges. Dispersed seeds may grow here and there in the irrigated field or by the hedge. Young plants are often collected in gardens and cultivated *rodat* in Qatar. The plant flowers during the summer. It has the name *Kharwaa*, which is used throughout the Arab countries.

An important industrial oil plant cultivated since ancient times in tropical and subtropical countries; it tolerates drought. The seed contains 70% oil, which is used in the chemical industry and as an aviation lubricant. The oil is known as a purgative (*oleum ricini*). Seeds contain also a toxic alkaloid, ricinine.

22. *RUTACEAE A. JUSS.*

Aromatic plants with pellucid glands on the leaves. Flowers actinomorphic (our species) or zygomorphic with disc. Sepals 4–5, free or united at base. Petals as many as sepals. Stamens 5 to numerous, usually free, sometimes united into fascicles. Fruit various, in our species a capsule.

1. ***Haplophyllum tuberculatum*** (*Forssk.*) *Adr. Juss.*, Mem. Mus. Hist. Nat. Paris 12: 528, t.

17, no. 10 (1825); *Aptophyllum*: Boiss., Fl. Orient. 1: 939 (1867); Burtt et Lewis, Kew Bull. 1954, 3: 408 (1954); Rech., Fl. Lowland Iraq 411 (1964), (1966); Zohary, Fl. Palaest. 2: 294, t. 432, 4312 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 334 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 166 (1978).

Ruta tuberculata Forssk., Fl. Aegypt.-Arab. 86 (1775). *Haplophyllum longifolium* Boiss., Diagn. Ser. 1, 8: 127 (1849) et Fl. Orient. 1: 941 (1867).

Perennial, many-stemmed, tuberculed. Leaves much variable in shape, lower leaves and those of sterile branches obovate to oblong–spathulate, tapering into a petiole, upper leaves linear, obtuse. Inflorescence corymbose; flowers bracteate, variable in size, subsessile. Petals yellow, 2–2·5 mm long.

The plant grows on fallow land and sandy soil. It is recorded in localities south of Qatar, and rarely found in Northern Qatar. Flowering from March to May (Plate 65).

23. *POLYGALACEAE A. JUSS.*

Herbs (our species), shrubs or climbers. Leaves usually alternate, simple, exstipulate. Flowers hypogynous, bisexual, actinomorphic, solitary or in spikes or racemes. Sepals 5, commonly unequal, the 2 inner often large and petaloid. Petals 3–5, the lowermost often concave with a fringed crest or keel. Stamens 8, monadelphous. Ovary 2-loculed, placentation axile. Fruit a capsule (our species), samara or drupe.

1. *POLYGALA L.*

Small annual or perennial herbs or subshrubs. Inflorescence terminal or axillary racemes. Sepals to the staminal tube, the lowest large, keeled, crested on its back, enclosing the stamens. Stamens 8, monadelphous. Fruit a flattened 2-lobular capsule.

1. Wing-like sepal not reticulate . . . . . . 1. *P. erioptera*
2. Wing-like sepal reticulate, veins frequently red 2. *P. irregularis*

1. *Polygala erioptera* *DC.*, Prod. 1: 326 (1824); Chadat, Monogr. Polygal. 2: 342 (1893); Burtt et Lewis, Kew Bull. 1949, 1: 307 (1949); Täckh., Stud. Fl. Egypt, ed. 2, 336 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 181 (1978).

Of variable habit, sometimes a small and delicate annual, sometimes tall with frutescent base and wiry branches. Leaves linear obtuse. Racemes 3-5-flowered, bracts persistent. Sepals 5; the outer 3 linear, the inner 2 ovate, obtuse, larger than the corolla, veins anastomosing. The wing-like sepal pale. Corolla keel 2·5–4·5 mm long. Capsule elliptic–oblong, emarginate, winged.

The plant is common in Qatar; it grows in sandy habitats. Flowering from February to April (Plate 65).

2. *Polygala iregularis* *Boiss.*, Diag. Ser. 1: 8 (1842); Täckh., Stud. Fl. Egypt, ed. 2, 337 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 181 (1978).

Similar to the above species; more or less puberulous. The wing-like sepal reticulate, veins frequently red.

It grows mixed with the above species.

24. *RHAMNACEAE* A. JUSS.

Trees, shrubs and woody climbers. Leaves alternate or opposite, simple, generally stipulate, frequently with 3–5 nerves. Flowers in axillary cymes or corymbs greenish or yellowish, usually small. Sepals 4–5, attached to a hypanthium. Petals occasionally as many as sepals or wanting. Stamens as many as petals and opposite them, usually arising from an intrastaminal disc which lines or rims the hypanthium. Fruit often drupaceous, or a capsule.

1. *ZIZIPHUS* MILL.

Shrubs or trees; branches often zig-zag, frequently with whitish bark. Leaves alternate, with 3 prominent nerves; stipules often thorny, 1 straight, the other often arcuate. Flowers bisexual, in axillary fascicles or cymes. Sepals 5; petals 5 (rarely absent). Fruit a drupe, yellow to brown.

In Qatar there are 3 species: 1 wild growing in the *rodat* especially in northern and central Qatar, and 2 cultivated species. The wild species is *Z. nummularia*, and the cultivated are *Z. mauritiana* and *Z. spina-christi.*

1. *Ziziphus nummularia* (*Burm. f.*) *Wight et Walk-Arn.*, Prodr. 162 (1834; *Zizyphus*); Boiss., Fl. Orient. 2: 13 (1872); Rech., Fl. Lowland Iraq 424 (1964); Zohary, Fl. Palaest. 1: 308, t. 451 (1966). *Zizyphus nummularia* (Burm. f.) Walk-Arn. *Rhamnus nummularia* Burm. f., Fl. Ind. 61 (1768).

A thorny, many stemmed shrub, 1–3 m high. Branches many, divaricate, flexuous, hairy to white-tomentose. Stipular spines 5–15 mm, usually one of them shorter and curved or none. Leaves 10–15, ovate-orbicular, mostly apiculate or mucronate, almost entire, hairy or tomentose on both sides, 3-nerved, petiole 2–5 mm, tomentose. Pedicels 5–10 mm. Flowers 3–4 mm, axillary, yellowish-green. Sepals triangular, grey tomentose. Petals as long as sepals, obovate. Fruit about 8 mm, almost globular, orange coloured.

Very common in Qatar; grows in the depressions (*rodat*) receiving considerable amount of runoff water and water-borne sediments. It forms a 1 m high or more phytogenic mound formed of the trapped fine alluvial deposits; called by the natives as *Nabk*. The name *Nabk* is used for mounds formed by *Ziziphus* in other Arab countries, e.g. Mauritania. In Egypt, cultivated *Z. spina-christi* is given the name *Nabq*. The local name of the plant in Qatar as well as many parts of Arabia is *Sidr*, a name given for *Ziziphus* trees in the Holy Quran. Flowering from May to July (Plates 66, 67).

The cultivated *Ziziphus*

2. *Ziziphus mauritiana* *Hamilt.* (= *Z. jujuba* Lam., Encycl. 3: 318 (1789)).

It is a large tree attaining a height of 6 m, cultivated in home gardens, hedgerows and

orchards. Leaves large, upper surface bright shining green, glabrous, lower surface white. Stipules not spiny. Fruit 1·5–3 cm long, 1–2·5 cm wide, yellow to orange when ripe.
The fruit is eaten and is locally called *Kenar* (Plate 68).

3. *Ziziphus spina-christi* (*L.*) *Willd.* (= *Rhamnus spina-christi* L., Sp. Plant. 1. 1105 (1753)).

A large tree (usually small in our area), unarmed (var. *rectus*). Leaves oblong–elliptic, with 3 conspicuous nerves. Stipules reduced or absent. Fruit globose, 1·3–1·8 cm diameter, yellow or reddish, brown when ripe.

The plant is frequently cultivated in Qatar in hedgerows and orchards. The fruit is locally known as *Nabq* (Plate 68).

25. *TILIACEAE A. JUSS.*

Trees, shrubs or herbs, leaves alternate, rarely opposite, generally simple; stipules present. Inflorescence cymose; flowers hermaphrodite, actinomorphic. Sepals 5 (rarely 3–4) free or partly connate; petals as many as sepals or sometimes absent. Stamens numerous, free or connate at base, sometimes fescicled; anthers 2-celled. Ovary superior, 2–10 carpelled. Fruit dry (in our species) or fleshy.

1. *CORCHORUS L.*

Herbs and undershrubs. Leaves alternate, serrate, pinnately nerved, usually with small stipules. Inflorescence a short peduncled 1–5-flowered cyme. Flowers yellow, axillary or opposite the leaves. Fruit a capsule dehiscing loculicidally, many seeded.

A. Perennial prostrate plants . . . . 1. *C. depressus*
B. Annual erect plants.
  1. Stems glabrous, capsule 5-valved, 10-ribbed . . 2. *C. olitorius*
  2. Stems hairy, capsule 3-valved, obscurely 6-ribbed 3. *C. trilocularis*

1. *Corchorus depressus* (*L.*) *Stocks* in Proc. Linn. Soc. 1: 367 (1848); Christensen in Dansk. Bot. Arkin. 4 (3): 34 (1922); Ghafour, Fl. Lib. 19: 4 (1977), *C. depressus* (L.) Christens in Täckh., Stud. Fl. Egypt, ed. 2: 146 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 113 (1978). *Antichorus depressus* L., Mant., Pl. 1: 64 (1767). *Chorchorus antichorus* Rdeusch., Nom. Bot., ed. 3, 3: 158 (1797).

A prostrate, glabrous, perennial, with many up to 30 cm long spreading thick tortuose branches from the woody rootstock. Leaves elliptic to broadly elliptic, 3-nerved, crenate–serrate, without basal setuse appendages; petioles filiform, hairy; stipules 2 mm long, linear. Cymes 2-flowered, leaf opposed. Flowers 6–8 mm across, yellow. Sepals 3–4 mm long, oblong. Petals obovate–spathulate, equalling sepals. Stamens 8–10. Ovary 4-carpelled, 4-locular. Capsule oblong–cylindrical, up to 20 × 2 mm, curved with about 2 mm long beak. Seeds blackish-grey.

This species is very common in Qatar. It grows on loamy compact soils in the form of mats close to the ground surface. Flowering mainly from February to May, also in all seasons (Plate 69).

2. *Corchorus olitorius* *L.*, Sp. Plant., ed. 1: 529 (1753); Boiss., Fl. Orient. 1: 845 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 247 (1972); Zohary, Fl. Palaest. 2: 310, t. 455 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 346 (1974); Ghafour, Fl. Lib. 19: 5 (1977); Meikle, Fl. Cypr. 1: 315 (1977); Migahid. Fl. Saudi Arab., ed. 2, 1: 113 (1978).

Erect annual, glabrous except petioles, 20–80 cm high. Leaves ovate to oblong–ovate, 4–8 × 1–4 cm; apex acute, margins sharply serrate, the two lowest serations produced in two conspicuous filiform appendages; petiole 1–3 cm long; stipules filiform 3–15 mm long. Flowers solitary or in minute 2–3-flowered cymes opposite the upper leaves; peduncles shorter than the petioles. Sepals 5, 8 mm long. Petals about 1 cm, yellow, obovate to spathulate. Capsule 5–10 × 0·3–0·5 cm, 5-valved, pentagonal–cylindrical, conical-beaked, 10-ribbed. Seeds many, angular, blackish.

The plant is cultivated in Qatar, as in all the Eastern Mediterranean countries and Egypt; it is used as a pot-herb. It escaped cultivation and is reported as a weed among irrigated crops.

3. *Corchorus trilocularis* *L.*, Syst. Nat., ed. 12, 2: 369 (1767); Mantissa Plant. 1: 77 (1967); Boiss., Fl. Orient. 1: 845 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 247 (1932); Zohary, Fl. Palaest. 2: 310, t. 454 (1972); Täckh., Stud. Fl. Egypt., ed. 2: 346 (1974); Meikle, Fl. Cypr. 1: 316 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 113 (1978).

Annual herb, 10–35 cm tall. Stems erect, hairy. Leaves 2 × 5 × 0·5–2 cm, stipulate; petiole short; lamina oblong–lanceolate, crenate–serrate, without filiform appendages. Flowers solitary or in small 2–3-flowered cymes opposite the upper leaves. Sepals boat shaped, longer than petals. Petals 5–7 cm, yellow, narrowly obovate. Stamens about 30. Ovary cylindrical, 3 mm long. Capsule 3-valved, prismatic–cylindrical, 45–70 mm long, obscurely 6-ribbed; apical beak 5 mm long. Seeds many, tetragonus, blackish.

It has been recorded only once in Al-Magdah depressions, northern Qatar. The plant was protected by the *Ziziphus* bushes. It appeared after heavy rainfall in March 1979, which caused flooding of depressions with runoff water. The collected specimens were flowering and fruiting in May.

26. *MALVACEAE A. JUSS.*

Herbs, shrubs or trees, usually with stellate hairs and mucilagenous sap. Leaves alternate, stipulate, often palmately lobed. Flowers actinomorphic, bisexual. Epicalyx usually present. Sepals 5, usually united. Petals 5, free or slightly united at base, usually contorted in bud. Stamens many, monadelphous; staminal tube enclosing the style; filaments free at the tip, each bearing a monothecous anther. Ovary superior, 5-locular; placentation axile; ovules 1 or more in each locule; styles divided at top into as many or twice as many lobes or stigmas as carpels. Fruit a loculicidal dehiscing capsule or a schizocarp of few to many mericarps, rarely a berry; mericarps indehiscent. Seeds often hairy.

A. Epicalyx absent . 1. *Abutilon*
B. Epicalyx 5–12-fid 2. *Althea*
C. Epicalyx 3-fid . 3. *Malva*

1. *ABUTILON MILL.*

Herbs or shrubs, tomentose. Leaves ovate–cordate, mostly dentate, sometimes lobed. Flowers large, axillary, solitary or few on raceme-like flowering branches. Epicalyx lacking. Calyx 5-cleft. Petals connate below and adnate to the base of the staminal column. Stamens numerous, monadelphous. Ovary 5 to numerous carpelled, each with 1–3 (–9) ovules; branches of styles as many as the carpels, papillose at apex. Fruit a schizocarp; mericarps, 1–3-seeded, beaked.

About 100 species, mainly in tropical regions, some of them weeds. Two species are recorded from Qatar.

A. Mericarps acuminate, acute at the apex 1. *A. fruticosum*
B. Mericarps rounded at the apex . . 2. *A. pannosum*

1. *Abutilon fruticosum* *Guill. et Perr.* in Guill., Perr. et Rich., Fl. Seneg. Tent. 70 (1831); Boiss. Fl. Orient. 1: 836 (1867); Zohary, Fl. Palaest. 2: 313, t. 458 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 354 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 123 (1978).

A. denticulatum (Fresen.) Webb, Fragm. Florul. Aethiop.-Aeg. 51 (1854) *Sida denticulata* Fresen., Mus. Sickenb. 1: 182 (1834).

Shrub, thinly velvety canescent, 1–2 m. Leaves long petioled; stipules caducous; lamina ovate–cordate, entire or minutely crenate. Flowers axillary, often solitary in the axils of short flowering branches. Calyx about 1 cm; corolla 1·5–2 cm; petals yellow to yellowish-white. Fruit longer than calyx; mericarps 8–11, united at base and not readily separating, 2–3-seeded, acute at apex. Seeds ovoid–reniform, tomentose.

The plant is occasional, mainly found in northern and central Qatar in the *rodat* protected by the dense growth of *Ziziphus nummulaira* bushes. Flowering from December to May (Plate 70).

2. *Abutilon pannosum* (*Forst. f.*) *Schlecht.*, Bot. Zeit. 9: 828 (1851); Webb, Fragm. Florul. Aethiop.-Aeg. 52 (1854; in obs.); Zohary, Fl. Palaest. 2: 313–314 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 354 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 123 (1978).

Sida pannosa Forst. f., Commentat. Soc. Sci. Gott. Ser. 2, 9 (ad. ann. 1787): 62 (1789). *Abutilon muticatum* (Del. ex DC.) Sweet, Hort. Brit., ed. 2, 65 (1830); Webb, l.c. 51; Boiss., Fl. Orient. 1: 836 (1867). *A. glaucum* (Cav.) Sweet, Hort. Brit. 54 (1826).

Shrub, up to 2 m, woolly canescent with stellate hairs mixed with dense patulous hairs; branchlets and pedicels with short glandular hairs. Leaves long petioled; stipules linear; lamina ovate–cordate, acute to acuminate, coarsely dentate, grey to yellowish. Flowers both axillary and terminal; lowermost flowers solitary; upper flowers in clusters. Calyx about 1·2 × 1·5 cm. Corolla twice as long as calyx or more, yellow or pink, yellow with purple centre. Mericarps 23–35, readily separating, rounded at apex. Seeds 2 mm, reniform.

Occasional in Qatar. In depressions with deep alluvial deposits, also on cultivated land in *rodat*. Flowering from April to August and also in other seasons (Plate 70).

2. *ALTHEA L.*

Annual or perennial hairy plants. Leaves palmate–cleft or parted. Flowers small,

hermaphrodite in leafy racemes or panicles. Epicalyx of 6–12 segments, united towards the base. Carpels forming a ring around central cyhlindrical axis, 1-seeded.

1. *Althea ludwigii* L., Mant. Plant. 98 (1767); Boiss., Fl. Orient. 1: 824 (1867); Rech., Fl. Lowland Iraq 426 (1964); Zohary, Fl. Palaest. 2: 328, t. 483 (1972); Täckh., Stud. Fl. Egypt., ed. 2, 353 (1974); Ali, Fl. Lib. 10: 2 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 123 (1978).

Malva aegyptia L. subsp. *ilijinii* Pamp. in Arch., Bot. (Nova Ser. 2) 12: 37 (1936).

Annual or perennial, prostrate herbs, with small palmate-lobed or parted leaves. Flowers axillary, clustered in leafy spike-like racemes above. Epicalyx 8–10 persistent segments. Calyx 6–10 mm long, villous; outer lobes linear. Corolla slightly longer than calyx, whitish blue. Fruit 6–8 mm across, mericarps 9–10, glabrous; axis of receptacle in a hairy conical beak. Seeds brown.

Common in Qatar on loamy and gravelly soil; mainly in depressions. Flowering from March to May (Plate 69).

3. *MALVA* L.

Herbs with palmate–cleft or parted leaves. Flowers purple, pink or white with an epixalyx of 3 free segments. Fruit flattened, circular, with numerous radiating carpels.

1. Epicalyx with ovate to oblong segments, usually broader than 2 mm. Petals long, twice as calyx . . . . 1. *M. nicaeensis*
2. Epicalyx with linear to linear–oblong segments, usually about 1 mm broad. Petals small, hardly exceeding calyx . . . . 2. *M. parviflora*

a. *Malva nicaeensis* All., Fl. Pedem. 2: 40 (1785); Boiss., Fl. Orient. 1: 819 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 236 (1932) Rech., Fl. Lowland Iraq 429 (1964); Zohary, Fl. Palaest. 2: 317, t. 465 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 349 (1974); Meikle, Fl. Cypr. 1: 310 (1977).

Annual or biennial, stems much branched, ascending to procumbent, glabrous or sparingly pilose. Leaves with long petioles up to 15 cm; blade orbicular to reniform in outline, often 3–5 palmately-lobed. Flowers 2–3 in axillary clusters. Epicalyx of 3 ovate-oblong bracteoles. Calyx 4–5 mm. Petals 0·7–1·2 cm, mauve. Fruit 0·8–1 cm in diameter.

Rare in Qatar; reported once in the government farm, northern Qatar. Flowering in April.

2. *Malva parviflora* L., Demonstr. Pl. Hort. Upsal. 18 (1753), Amoen., Acad. 3: 316 (1756) et Sp. Plant., ed. 2 (1763); Boiss., Fl. Orient. 1: 820 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 237 (1923); Rech., Fl. Lowland Iraq 430 (1964), 2, 349 (1974); Meikle, Fl. Cypr. 1: 311 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 114 (1978).

Annual, hairy or glabrescent, procumbent. Leaves obtusely-lobed, flowers minute, 2–4 or more in axillary clusters. Epicalyx of 3 linear bracteoles. Calyx 3–6 mm, growing up to 0·8–1 cm in fruit. Petals 57 mm, hardly exceeding calyx, pink to purple. Fruit 4–7 mm in diameter.

Common plant in depressions, cultivated and fallow fields. Flowering from February to May. Local name: *Khobbeiz* or *Khobbeizah*.

27. *CISTACEAE A. JUSS.*

Herbs, subshrubs and shrubs. Leaves opposite. Flowers solitary or in cymes or cymose racemes, actinomorphic, hermaphrodite. Sepals 3–5, frequently unequal, the outer shorter than the inner. Petals 5 or 3, free, often caducous. Stamens numerous, free, inserted on a disc-like projection of the receptacle, the oldest stamens being those below the pistil, the younger ones are found below. Ovary superior, 1-loculed, placentation parietal. Fruit a loculicidal capsule.

HELIANTHEMUM MILL.

Dwarf shrubs or perennial or annual herbs. Leaves opposite or the upper leaves sometimes alternate. Flowers yellow (our species) or rose-coloured in false spikes or racemes. Sepals 5, the outer 2 mostly smaller. Stamens numerous. Capsule 3-valved, splitting down the valves.

1. Flowers pedicelled, pedicals as long as calyx 1. *H. kahiricum*
2. Flowers subsessile . . . . 2 *H. lippii*

1. *Helianthemum kahiricum* *Del.*, Fl. aegypt. Ill. 65 (1813) et Fl. Egypt, 93, t. 31, F. 2 (1813); Boiss., Fl. Orient. 1: 442 (1867); Zohary, Fl. Palaest. 2: 340, t. 500 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 364 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 102 (1979).
Cistus stipulatus Forssk., Fl. Aegypt.-Arab. 101 (1775).

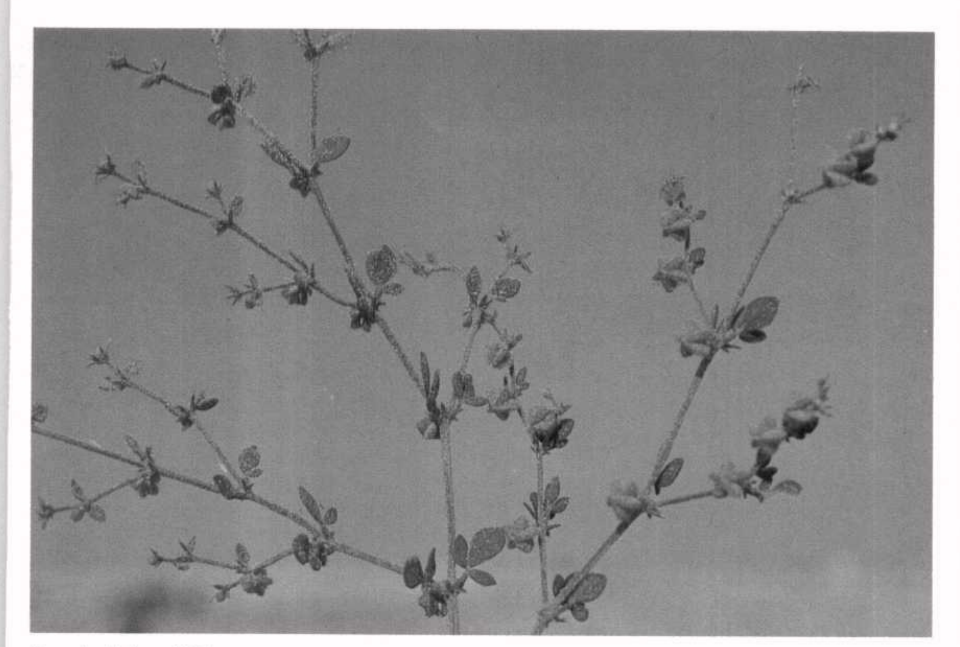
Dwarf shrublet, 10–30 cm. Leaves oblong to oblong–lanceolate, revolute-margined; stipules minute. Inflorescence 1-sided with 5–12 flowers. Bracts shorter than pedicels. Pedicels as long as calyx, deflexed and elongating after flowering. Petals not or only slightly exceeding calyx, lemon-yellow. Capsule shorter than the fruiting calyx.

The plant is fairly common in Qatar. It grows on rocky ground, especially calcareous rocks. Flowering from February to May. Local name is *Ragroug* (Plate 71).

2. *Helianthemum lippii* *(L.) Dum.-Cours.*, Bot. Cult. 3: 130 (1802); Pres., Syn. Plant. 2: 78 (1806); Rech., Fl. Lowland Iraq 438 (1964); Zohary, Fl. Palaest. 2: 342, t. 504 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 364 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 102 (1978).

Dwarf undershrub, 20–30 cm. Stems numerous, dichotomously and intricately branched into spreading and horizontal twigs. Older branches with fissured bark, becoming spinescent. Leaves elliptical revolute-margined; winter leaves soon deciduous, larger than the summer leaves. Inflorescence spike-like, 1-sided, loosely 3–8-flowered. Flowers subsessile. Calyx hairy. Petals somewhat longer than calyx, yellow capsule as long as the fruiting calyx or somewhat shorter.

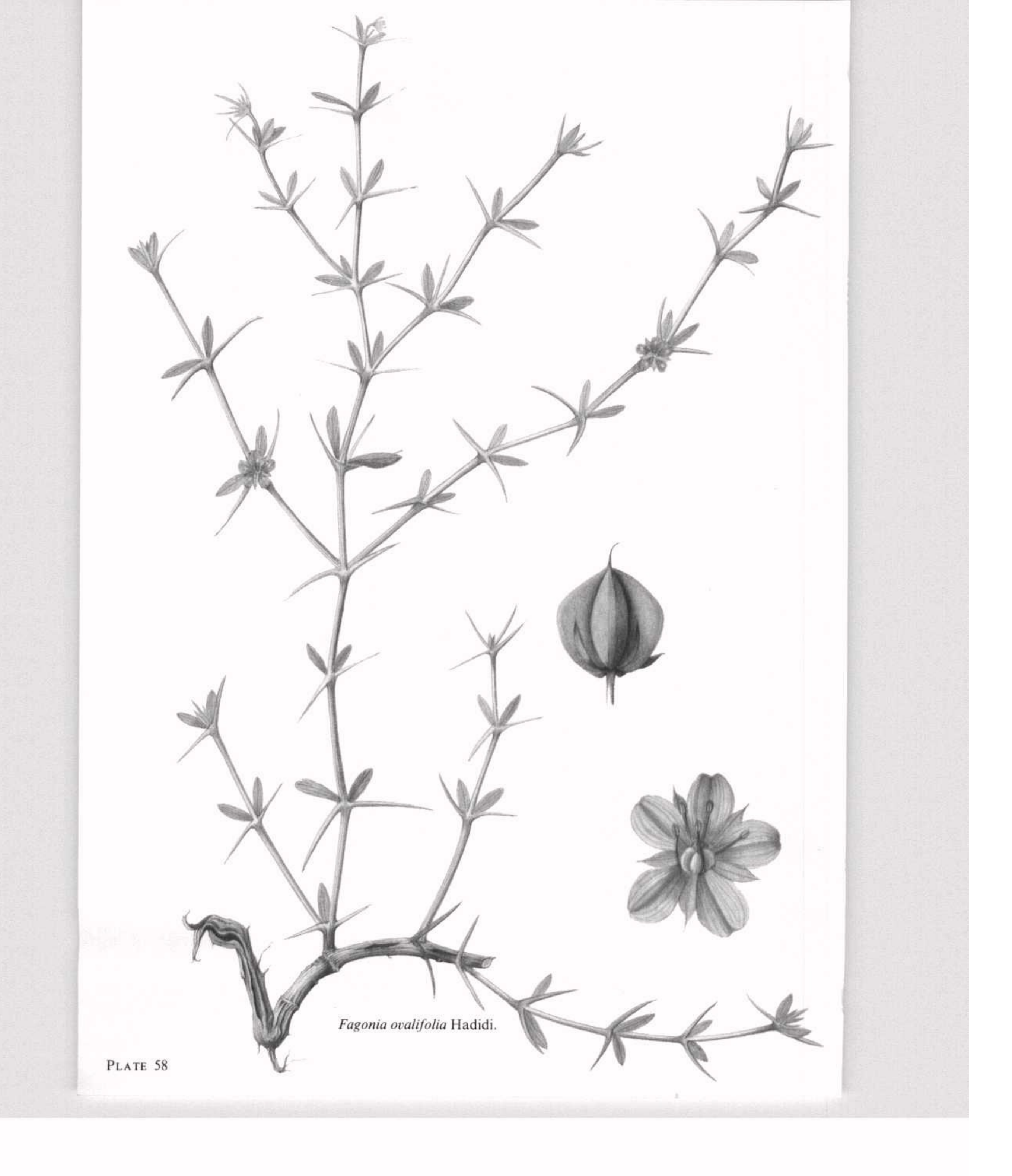
The plant is very common in Qatar. It grows in shallow depressions and dominates a plant community in different localities in the country. The plant appears leafless and spinescent in summer and autumn. Flowering from February to April. The plant is known locally as *Ragroug*. It is reported that truffles grow associated with the plant growth dominated by this species (Plates 71, 72).



Fagonia glutinosa Del.



Fagonia indica Burm. f.

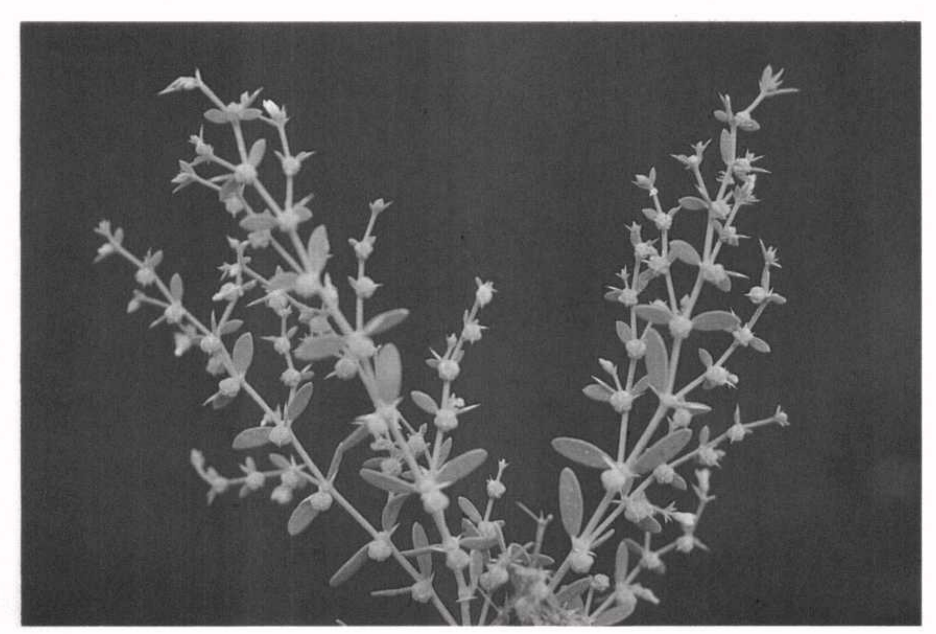


Fagonia ovalifolia Hadidi.

PLATE 58



Fagonia ovalifolia Hadidi var. *ovalifolia.*



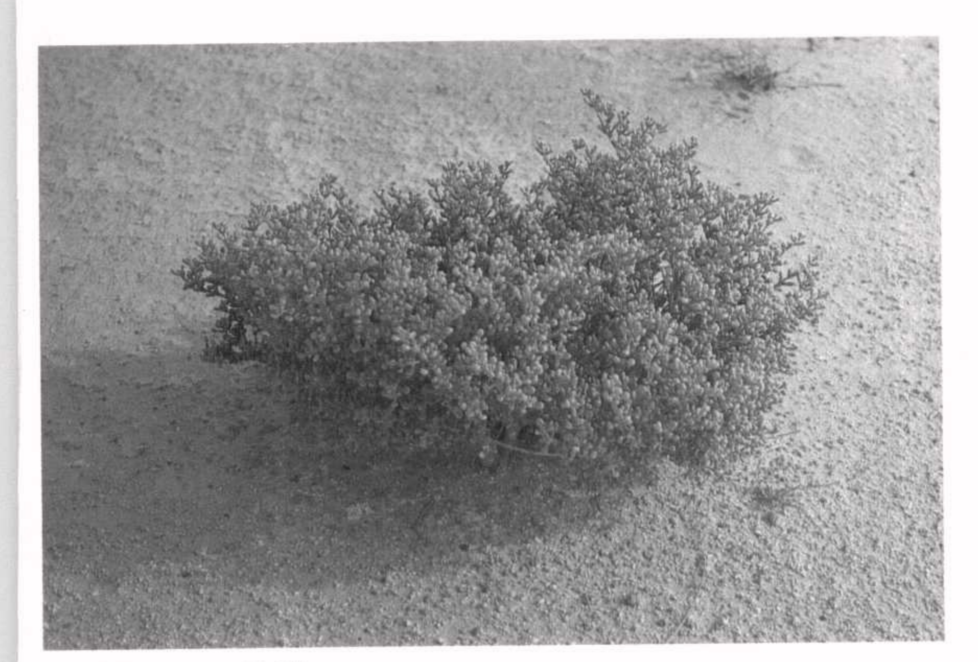
Fagonia ovalifolia Hadidi var. *pakistanica* Ghafour.



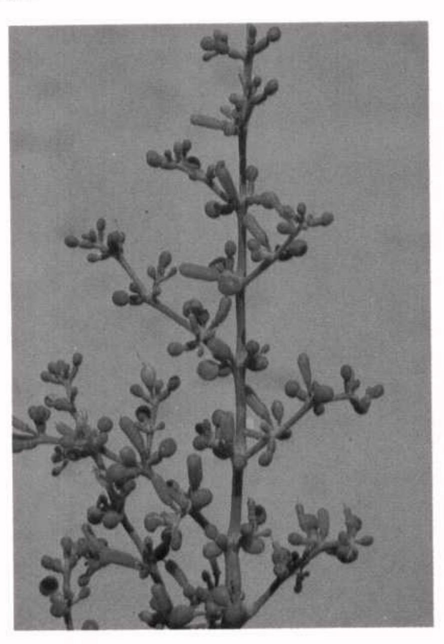
Seetzenia orientalis Decne.



Tribulus terrestris L.



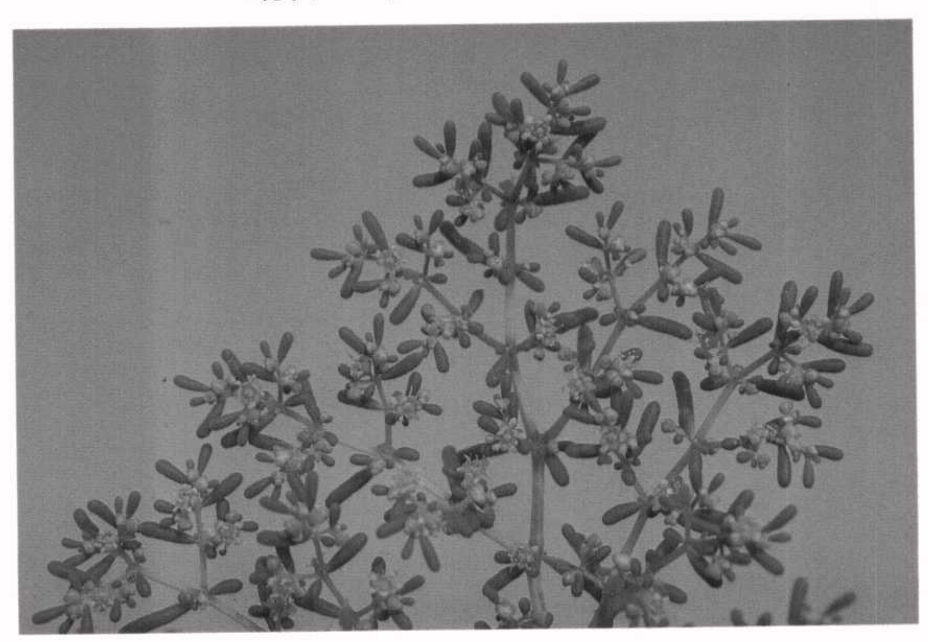
Zygophyllum quatarense Hadidi.



Zygophyllum quatarense Hadidi.



Zygophyllum simplex L.



Zygophyllum simplex L.

PLATE 62



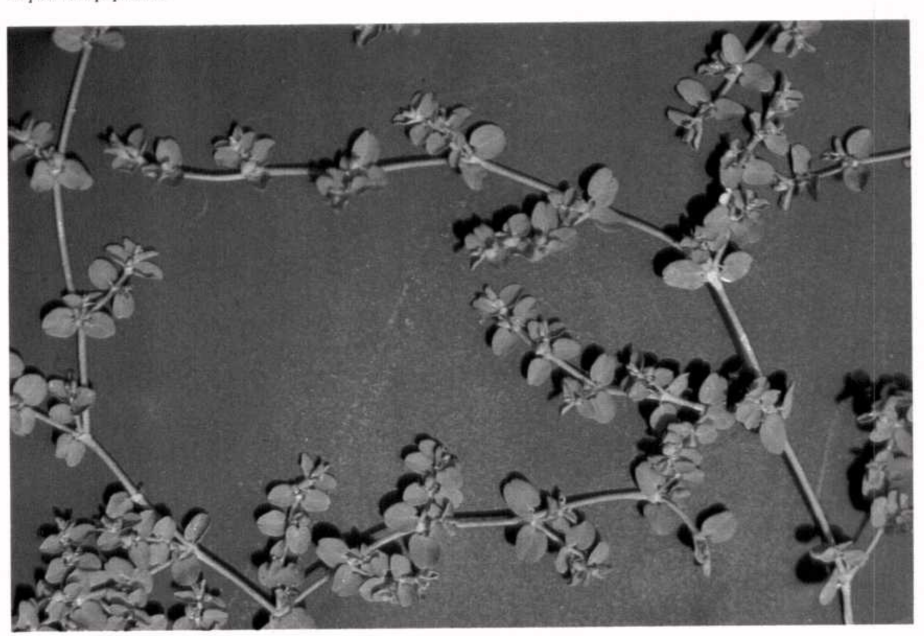
Andrachne telephioides L.



Euphorbia granulata Forssk.



Euphorbia peplus L.



Euphorbia prostrata Ait.

PLATE 64

28. *TAMARICACEAE S. F. GRAY*

Trees or shrubs, often with small, scale-like, alternate, exstipulate leaves. Flowers solitary or in spikes or racemes, actinomorphic, bisexual, often small. Sepals 4–5, free or partly connate. Petals as many as sepals, free, inserted below a nectariferous disc. Stamens as many as or twice as many as petals. Ovary superior, 1-loculed. Fruit a capsule dehiscing into valves.

1. *TAMARIX L.*

Trees or shrubs. Leaves small, scale-like. Flowers in catkin-like racemes or spikes. Sepals 4–5, free or almost so; petals 4–5; stamens 4–14. Ovary tapering to a conical apex; ovules numerous.

I. Leaves sheathing without blade, stamens 5 . . . . . . 1. *T. aphylla*
II. Leaves not sheathing, with free distinct blade, stamens 10–13 2. *T. passerinoides*
III. Leaves sessile or half-clasping, stamens 5 . . . . 3. *T. ramosissima*

1. *Tamarix aphylla* *(L.) Karst.*, Deutsch. Fl. 641 (1880–83); Burtt et Lewis, Kew Bull. 1954, 3: 388 (1954); Schiman-Czeika in Rech., Fl. Lowland Iraq 437 (1964); Zohary, Fl. Palaest. 2: 359, t. 522 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 366 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 102 (1978).

Thuja aphylla L., Cent. Pl. 1: 35 (1755). *Tamarix orientale* Forssk., Fl. Aegypt.-Arab. 206 (1775). *T. articulata* Vahl, Symb. Bot. 2: 48, t. 32 (1791).

Tree or high shrub, with reddish-brown to grey bark, 4–12 m. Branches jointed, green. Leaves about 2 mm, sheath-like, with an abruptly short-pointed apex. Racemes short-peduncled, rather dense. Pedicels much shorter than the calyx. Sepals 5, about 1·5 mm. Petals 5, about 2 mm. Stamens 5. Styles 3. Capsule about 3 mm, pyriform.

Grown as a shade and afforestation tree; also around cultivated *rodat*. The plant propagates readily by cuttings. Flowering from August to November. Local name: *Athl* or *Tarfah*.

2. *Tamarix passerinoides* *Del. ex. Desv.* in Ann. Sci. Nat. Ser. 1, 4: 349 (1825); Burrt et Lewis, Kew Bull. 1954, 3: 389 (1954); Schiman-Czeika in Rech., Fl. Lowland Iraq 437 (1964); Zohary, Fl. Palaest. 2: 361 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 367 (1974); Migahid, Fl. Saudi Arab., ed. 2, 110 (1978).

Shrub, green or glaucescent, glabrous. Leaves nearly clasping, ovate deltoid. Racemes dense, from woody branches, 6–8 times as long as broad, with large pinkish flowers. Petals rather persistent. Stamens 10–13. Capsule up to 9 mm long.

Grows in salines. Flowering from April to November. Local name: *Athl* or *Tarfa*, a name used for different *Tamarix* species.

3. *Tamarix ramosissima* *Ledeb.*, Fl. Alt. 1: 424 (1829); Schiman-Czeika in Rech., Fl. Lowland Iraq 437 (1964).

A glabrous shrub. Leaves sessile, half-clasping, acute. Racemes 2–5 cm long, subsessile

or peduncled, dense, stiff. Corolla persistent. Stamens 5. Styles club-shaped, at most as long as the half of the ovary.

On saline ground, particularly in southern Qatar. Flowering from March to December. Local name: *Athl* or *Tarfa*.

29. *FRANKENIACEAE* A. ST. HIL.

Annual or perennial herbs or subshrubs. Stems much branched. Leaves opposite, often small, exstipulate. Flowers solitary or in terminal or axillary cymes. Sepals 4–6, persistent, united into a tube. Petals equal in number to sepals, clawed, with a scale-like appendage on the claw. Stamens 6 in 2 whorls. Ovary superior, 1-loculed, with 2–4 parietal placentae. Fruit a loculicidal capsule.

1. *FRANKENIA* L.

Herbaceous annuals or subshrubby perennials. Leaves opposite or clustered, rarely over 1 cm long. Flowers in axillary or terminal dichasia. Calyx tubular (4-) 5-fid. Petals (4-) 5-fid, small, pink. Stamens 6. Ovary 5-carpelled. Capsule 3-valved, dehiscent.

1. *Frankenia pulverulenta* L., Sp. Plant., ed. 1, 332 (1753); Boiss., Fl. Orient. 1: 779 (1867); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 225; Zohary, Fl. Palaest. 2: 364, t. 530 (1972); Täckh., Stud. Fl. Egypt, ed. 2: 369 (1974); Meikle, Fl. Cypr. 1: 210 (197); Migahid, Fl. Saudi Arab., ed. 2, 1: 110 (1978).

Procumbent, much-branched annual, 5–20 cm. Leaves usually in whorls of 4, obovate to oblong, turning sometimes reddish. Flowers 4–5 mm, sessile in the forks of branches or axillary. Calyx about 4 mm. Petals 3·5–5 mm, pale or deep violet. Stamens 6. Capsule 2·5–3 mm, 3–valved, ovoid.

The plant is common in Qatar. It grows on salines as well as salinized cultivated land. Flowering from February to May (Plate 73).

30. *CUCURBITACEAE* A. JUSS.

Mostly herbaceous, climbing or trailing, generally with tendrils. Leaves alternate, palmately veined. Flowers commonly yellowish, regular, unisexual, monoecious or dioecious, the male usually racemose, the female often solitary. Calyx short-campanulate, the tube adnate to the ovary, the limb usually 5-lobed. Corolla 5-lobed. Stamens 5. Ovary inferior, with parietal placentation. Fruit a berry or firm-walled berry.

1. Female flowers without a ring-shaped disc surrounding the base of the style; fruit apple size; leaves usually deeply, pinnately, divided . . . 1. *Citrullus*
2. Female flowers with a ring-shaped disc surrounding the base of the style, fruit smaller, leaves palmately, often rather shallowly lobed . . . 2. *Cucumis*

1. *CITRULLUS* ECKL. ET ZEYH.

Annual or perennial (our species), trailing (ours) or climbing herbs. Leaves usually deeply, pinnately, lobed. Tendrils simple or 2–4-branched. Flowers monoecious, solitary, yellow, or outside green. Hypanthium short, obconic in male flowers, very shortly cylindrical in female flowers. Fruit large, ellipsoid or subglobose.

1. *Citrullus colocynthis* *(L.) Schrad.*, Linnaea 12: 414 (1838); Rech., Fl. Lowland Iraq 584 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 374 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 112 (1978).

Cucumis colocynthis L., Sp. Plant., ed. 1, 1011 (1753). *Colocynthis vulgaris* Schrad., Ind. Sem. Hort. Goett. 2 (1833).

Prostrate trailing perennial herb; rootstock deep, stout, rather woody; stems annual, angled. Leaves petiolate, triangular in outline, scabrid–hairy beneath, scabrid punctate above, deeply 3–5-lobed, lobes pinnately lobulate. Tendrils simple or less often bifid. Male flowers on peduncles 1–2 cm long; hypanthium green, broadly obconic; sepals lanceolate; petals pale yellow. Female flowers on peduncles 1–4 cm long. Fruit subglobose, smooth, fleshy, mottled with dark green turning dry and yellow when ripe, apple size, extremely bitter in taste.

Common in Qatar and grows on sandy and compact soils. It flourishes in summer. Flowering from May to July. Local name: *Shary*; the name is usually given to the fruits. In other Arab countries the plant is known as *Hanzal* or *Handhal*. Fruits are used in the folk medicine and sold in folk drug shops (Plates 73, 74).

2. *CUCUMIS* L.

Annual or perennial (ours) climbing or trailing herbs, with tendrils. Leaves usually palmately, sometimes deeply lobed. Tendrils simple. Flowers usually monoecious, axillary, the male solitary or in small fascicles, the female solitary. Hypanthium campanulate. Petals yellow, united at base. Fruit fleshy, many-seeded, in our species ellipsoid, spiny or prickly tubercled, rarely smooth.

1. *Cucumis prophetarum* *Jusl. ap. L.*, L. Cent. 1: 32 (1759) et Amoen. Acad. 4, 295 (1759); Täckh., Stud. Fl. Egypt, ed. 2, 376 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 111, t. 115 (1978).

Whitish-grey bristly prostrate perennial herb, with slender, elongated and much-branched prostrate stems. Stems angular–sulcate, rough, geniculate at the joints. Leaves cordate–ovate or palmately 3–5-lobed; lamina rigidulus with crisped whitish-grey scabrid margin, nerves very prominent and reticulate on the lower surface; petiole slender, fragile, very densely hirsute, 2–4 cm long. Flowers monoecious, yellow with acute lobes; male flowers often clustered, female ones solitary. Fruit globose, puberulous, variegated, 3–4 cm in diameter, with green longitudinal stripes alternating with white ones; fruit surface bare between the spines or tubercles; fruit prickles robust, rarely pointed, 1–3 mm long; ripe fruit of uniform yellow colour; fruit stalk thin, up to 4 cm long. Fruit many-seeded.

Occasional in Qatar, on gravelly soil. Flowering from April to May. Local name: *Shary*, known in Arabia as *Hadaj* (Plates 73, 74).

31. *CYNOMORIACEAE LINDL.*

Fleshy blackish-red leafless root-parasite, with thick reddish-brownish rhizomes. Flowers minute, densely crowded on a terminal, club-shaped spadix. Bracts deciduous. Male flowers with a simple perianth of 3–4 free or connate segments, whitish to reddish tipped; stamen 1. Female flowers smaller; perianth 1–5, whitish; ovary 1-celled, 1-ovuled. Fruit nut-like indehiscent. Seeds solitary in fruit cavity.

1. *CYNOMORIUM L.*

Fleshy leafless herbs, destitute of chlorophyll, parasitic on roots. Flowers minute, crowded, on a fleshy, club-shaped spadix, male, female and bisexual among each other. Perianth segments 1–5; stamen 1, anthers 2-celled; ovary superior, 1-celled. Fruit nut-like, with the persistent perianth and style at summit.

One species. The genus is sometimes included under *Balanophoraceae* (Webb in Tutin *et al.*, Fl. Europ. 1: 75, 1964) which has perianth usually absent in female flowers, ovary superior to inferior and ovules without integument.

1. ***Cynomorium coccineum*** L., Sp. Plant., ed. 1, 970 (1753); Boiss., Fl. Orient. 4: 1073 (1879); Ozenda, Fl. Sahara 195, t. 45 (1958); Zohary, Fl. Palaest. 1: 51 (1966); Täckh., Stud. Fl. Egypt, ed. 2, 382, Plate 131 (1974); Jafri, Fl. Lib. 17: 1–4 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 374 (1978).

Fleshy perennial, up to 30 cm, with branching rootstock. Stems unbranched, cylindrical, reddish, with few deciduous scales, ending in long, thick, club-shaped spikes. Inflorescence 10 × 4·5 cm, terminal, with congested flowers, only red-coloured stamens protruding out irregularly. Cymes 1–4 flowered, covering the surface of the spike. Male flowers about 1·5 mm long on about 1·5 mm long pedicels. Female flowers about 3 mm long, on up to 2 mm long pedicels. Fruit orbicular, 1-seeded. The plant is parasitic on chenopods of salt marshes and maritime sands. It is rare in Qatar. Local name is *Tarthuth*; it is edible by natives. The name is used throughout the Arab countries. Flowering from April to July (Plate 75).

32. *UMBELLIFERAE A. JUSS.*

Mostly herbs with often furrowed and commonly hollow stems. Leaves alternate, much divided, petioles expanding or sheathing at base. Inflorescence typically a compound umbel with bracts and bracteoles. Flowers small, calyx obsolete or merely a 5-toothed border. Petals 5. Stamens 5. Ovary inferior with 2 styles on a swollen base 'stylopodium'. Fruit schizocarp of 2 mericarps on a carpophore, each usually with 5 ribs, often with resinous canals 'vittae' between the ridges.

A. Leaves undivided with entire margin . . . . 3. *Bupleurum*
B. Not so.
  1. Flowers white . . . . 1. *Ammi*
  2. Flowers yellow.
    a. Fruit cylindrical; leaf-sheaths conspicuous, up to 20 cm 4. *Foeniculum*
    b. Fruit compressed, or flattened dorsally; leaf-sheaths inconspicuous, much less than 20 cm long . . . . 2. *Anethum*

1. *AMMI* L.

Annual or biennual glabrous herbs. Leaves 1–3 pinnatisect into filiform or lanceolate segments. Umbels terminal or axillary. Bracts and bracteoles numerous, filiform. Calyx obsolete, petals white. Fruit laterally compressed, small, ovoid or oblong.

1. *Ammi majus* *L.*, Sp. Plant., ed. 1, 243 (1753); Boiss., Fl. Orient. 2: 891 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 525 (1932); Davis, Fl. Turkey 4: 427 (1972) Zohary, Fl. Palaest. 2: 417, t. 603 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 390 (1974); Meikle, Fl. Cypr. 1: 740 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 381 (1978).

Annual, glabrous, 30–70 cm. Stem erect, much-branched especially above, stiff, furrowed. Lower leaves long-petioled, pinnately divided with oblong to lanceolate segments, usually withered at anthesis; upper leaves less divided, segments serrate. Umbels long-peduncled, fruiting umbels open. Bracts much shorter than the rays, 3–5-partite into linear or filiform segments. Bracteoles subulate. Pedicels much longer than the flowers and fruits. Fruit 1·5–2 mm, oblong to ovoid.

A weed in cultivated land. Local name: *Khillah* (Plate 75).

2. *ANETHUM* L.

Erect, glabrous, aromatic annual. Leaves 3–4 pinnatisect, ultimate segments filiform. Bracts and bracteoles absent. Flowers yellow. Fruit dorsally flattened.

1. *Anethum graveolens* *L.*, Sp. Plant. ed. 1, 263 (1753); Boiss., Fl. Orient. 2: 1026 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1–554 (1932); Davis, Fl. Turkey 4: 377 (1972); Zohary, Fl. Palaest. 2: 433, t. 627 (1972); Meikle, Fl. Cypr. 1: 751 (1977).

Annual, strongly aromatic, glabrous, 30–60 cm. Leaves 3–4 pinnatisect, segments filiform; sheaths up to 10 cm long, auriculate at apex with narrow membranous margins. Umbels 15–30-rayed, almost equal. Bracts and bracteoles absent. Fruit 3–6 mm long, 2–3 mm wide; ribs prominent, the marginal ribs winged (Plate 75).

The plant is cultivated in Qatar and is used as a green salad. It escapes cultivation and is usually met with in land cultivated with vegetables.

Flowering from March to May. Local name: *Shabat*.

3. *BUPLEURUM* L.

Annual (ours) or perennial herbs, with alternate simple entire leaves, the lower generally petiolate, the upper often sessile or sometimes perfoliate. Umbelo compound. Flowers green or yellow. Calyx lobes obsolete or inconspicuous. Petals small, incurved. Fruit with 5 prominent ridges.

1. *Bupleurum semicompositum* *L.*, Demonstr. Plant. 7 (1753); Davis, Fl. Turkey 4: 405 (1972); Zohary, Fl. Palaest. 2: 415, t. 599 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 387, t. 133 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 376 (1978).

B. glaucum Robill et Cast. in Lam. et DC., Fl. France 6: 515 (1815); Boiss., Fl. Orient. 2: 842 (1872); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 511 (1932).

B. semicompositum L. var. *glaucum* (Robill et Cast.) H. Wolff. in Engl., Pflanzenr. 43 (IV, 228): 106 (1910).

Small annual glabrous herb, 3–20 cm high; with slender repeatedly branched stems. Leaves narrow, linear, upper ones smaller. Umbels terminal and lateral, 3–4-rayed, the lateral sessile or subsessile, the terminal with peduncles up to 1·5 cm. Bracts 4; bracteoles usually 5, both linear–lanceolate, herbaceous. Bracteoles much exceeding the flowers. Flowers 4–7 in each umbellule; pedicels unequal, very short, rarely exceeding 2 mm. Petals 0·3–0·4 mm. Fruit subglobose, laterally compressed, about 1 mm diameter.

Very rare in Qatar; on sandy soils. Flowering in March.

4. *FOENICULUM MILL.*

Aromatic biennial or perennial herb. Leaves 2–4 pinnatisect into filiform lobes. Bracts and bracteoles absent. Flowers yellow. Fruit oblong–cylindrical.

1. *Foeniculum vulgare* *Mill.*, Gard. Dict., ed. 8, no. 1 (1768); Davis, Fl. Turkey 4: 376 (1972); Zohary, Fl. Palaest. 2: 432, t. 626 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 392 (1974); Meikle, Fl. Cypr. 1: 749 (1977).

Anethum foeniculum L., Sp. Plant., ed. 1, 263 (1753). *Foeniculum officinale* All., Fl. Ped. 2: 25 (1785); Boiss., Fl. Orient. 2: 925 (1872).

Tall, erect perennial or biennial up to 2 m high; smelling pleasantly of aniseed when crushed. Leaves divided into numerous filiform segments; basal sheath conspicuous, ribbed, up to 20 cm long and 3·5 cm wide. Umbels 3–30-rayed; rays subequal. Flowers small, yellow; bracts and bracteoles absent. Fruit oblong, 4–6 mm long, 2·5–3 mm wide.

The plant is cultivated in Qatar. It escaped cultivation and is usually found among vegetables.

Local name: *Shamar*. Flowering from May to June.

33. *PRIMULACEAE VENT.*

Annual (our species) or perennial herbs. Leaves simple, exstipulate. Flowers actinomorphic, bisexual. Sepals 5, persistent. Petals 5. Stamens 5, epipetalous. Ovary superior, 1-loculed, with numerous ovules on a basal or free central placenta. Fruit a capsule with small seeds.

1. *ANAGALLIS L.*

Annual procumbent herbs with opposite or alternate leaves. Flowers solitary, axillary, pedicellate (our species), or rarely subsessile. Calyx 5-lobed. Corolla rotate, lobes mostly free. Stamens 5, epipetalous, filaments bearded. Capsule globose, circumsessile, many-seeded.

1. *Anagallis arvensis* *L.*, Sp. Plant., ed. 1, 148 (1753); Rech., Fl. Lowland Iraq 472 (1964);

Täckh., Stud. Fl. Egypt, ed. 2, 399 (1974); Ali, Fl. Lib. 1: 1–16 (1976); Migahid, Fl. Saudi Arab., ed. 2, 1: 388 (1978).

Annual procumbent herbs with opposite, entire, ovate or broadly lanceolate, glabrous, acute leaves. Stem glabrous, branched at the base, tetragonal, erect, 10–20 cm high. Flowers blue (our specimens); pedicel long, about 2·5 cm, a little longer than the leaves, recurved in fruit. Capsule globose with a 4 mm long persistent style. Fruit transversely dehiscent.

A. arvensis L. seems to be represented in Qatar exclusively by var. ***coerulea*** characterized by blue flowers.

Fairly common in Qatar. It grows as a weed in gardens and cultivated land, also in *rodat* in northern Qatar receiving considerable amounts of runoff water, particularly in the shade of *Acacia* trees. Flowering from February to March. Arabic name: *Ein Al-Quitt*, meaning cat's eye referring to its globose fruit (Plate 75).

34. *PLUMBAGINACEAE A. JUSS.*

Herbs or undershrubs. Leaves alternate or in a basal rosette, exstipulate, frequently with chalk glands. Flowers bisexual, regular, in lateral and terminal panicled, few-flowered, helicoid cymes or in dense elongate, terminal or terminal and lateral spikes. Calyx funnel-shaped, usually membranous between the ribs. Petals 5, usually persistent. Stamens 5, opposite the corolla lobes. Ovary superior, 1-locular, styles 5, free or connate; ovule solitary. Fruit a utricle included in the calyx.

1. *LIMONIUM MILL.*

Annuals or undershrubs, usually with rosetted leaves, frequently with chalk glands. Flowers arranged in 3-bracted spikelets together forming branched 1-sided spikes. Flowers papery.

1. *Limonium axillare* (Forssk.) Kuntze, Revis. Gen. Z. 395 (1891); Täckh., Stud. Fl. Egypt, ed. 2, 403 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 388 (1978).

Statica axillaris Forssk., Fl. Aegypt.-Arab. 58 (1775); Boiss., Fl. Orient. 4: 868 (1879); Blatter, Fl. Arab. 3: 284 (1921).

Low shrub, with decumbent or ascending branches or scapes erect from a woody rootstock. Leaves fleshly, spathulate, petiolate with glands secreting salts. Flowers minute, pale pink or purplish, in a naked terminal panicle.

The plant is very common along the coasts of Qatar in salines. It is a salt-secreting halophyte, dominating a plant community. Flowering from March to May. Local name: *Qataf, Gataf* (Plate 76).

35. *GENTIANACEAE A. JUSS.*

Usually herbs with opposite, entire, exstipulate sessile leaves. Flowers solitary or in cymes, actinomorphic, bisexual. Calyx persistent, 5–8-cleft. Corolla 5–10-lobed, funnel-

shaped or rotate, persistent. Stamens equalling in number and alternating with the corolla lobes, epipetalous. Ovary superior, 1-loculed, with 2 parietal placentae. Fruit a capsule, 2-valved, with numerous seeds.

1. *CENTAURIUM HILL.*

Annual glabrous herbs of moist habitat with opposite entire sessile stem leaves. Flowers 5-fid with tubular calyx and funnel-shaped corolla, spicate or in forked cymes. Stamens 5, inserted on upper part of corolla-tube; the anthers exserted, at length spirally twisted. Capsule 2-valved, many-seeded.

1. *Centaurium pulchellum* *(Sw.) Druce*, Fl. Oxf. 342 (1897); Rech., Fl. Lowland Iraq 477 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 407 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 394 (1978).

Erythraea pulchella (Sw.) Fries (1814); Post, Fl. Syr., Pal. et Sinai. 2: 148 (1933).

Annual, 20–60 cm, glabrous. Stems erect, stiff-branched. Leaves of the basal rosette ovate, obtuse, withered at flowering time, the upper leaves ovate–lanceolate, acute, 15–25 mm long, 4 mm wide. Flowers pedicelled in forked cymes, rose-coloured with tube hardly exserted above calyx. The whole plant forms a lax leafy corymbosely cymose inflorescence. Corolla 3–4 mm long, anthers 1·5 mm long.

Very rare in Qatar; recorded once at Al-Wabrah in a shaded moist habitat beside an irrigation canal. The collected material was flowering in May.

36. *ASCLEPIADACEAE R. BR.*

Perennial herbs, shrubs, climbers or trees, sometimes succulent and mostly with milky juice. Leaves simple, entire, mostly opposite or whorled, extipulate. Flowers actinomorphic, bisexual, 5-merous. Stamens 5, with the anthers united laterally to form a 5-sided blunt cone which is usually attached on the inside to the stigma-head, thus forming a 'gynostegium'. In addition either corolla or stamens or both may bear appendages, forming a single or double corona. Fruit a pair of follicles containing numerous ovate–oblong seeds crowned by a tuft of hairs.

I. Herbs with broad leaves 1. *Glossonema*
II. Leafless shrubs . . . 2. *Leptadenia*

1. *GLOSSONEMA DECNE.*

Small perennial herb with opposite leaves. Flowers inconspicuous, axillary. Calyx 5-partite. Corolla 5-lobed, corona arising from the corolla tube. Fruit ovate with acuminate tip, pubescent, softly spiny.

1. *Glossonema edule* *N.E. Br.* Kew Bull. 183 (1895): Blatter Fl. Arab. 3: 295 (1921).

Perennial hairy herb. Leaves opposite, petioled, ovate with wavey crisped margin. Flowers in axillary cymes, not exceeding the leaves, yellowish. Fruit ovate with acuminate tip, pubescent, covered with soft spines. Seeds ovate in outline, with tuft of hairs.



Haplophyllum tuberculatum (Forssk.) A. Juss.



Polygala erioptera DC.

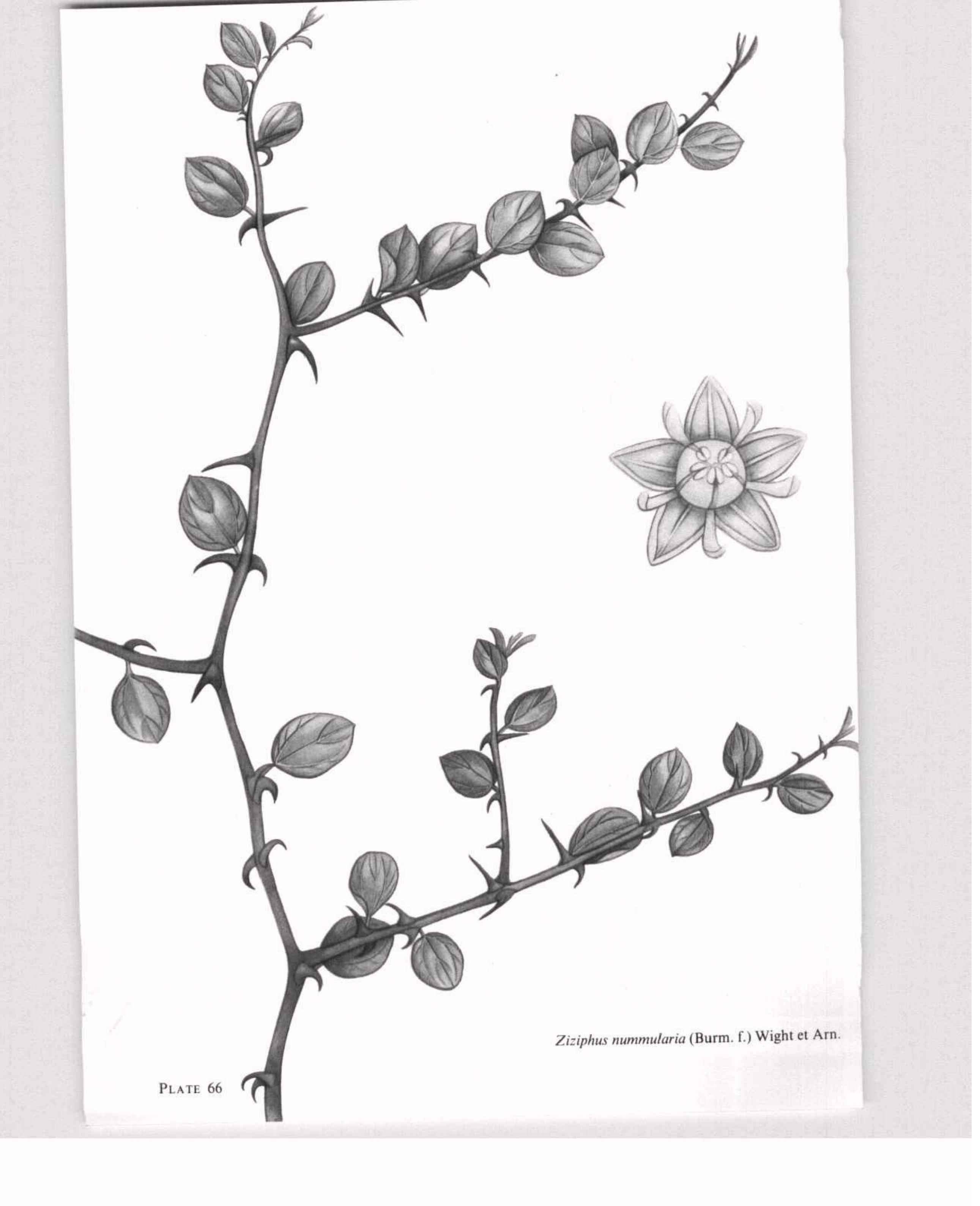


PLATE 66

Ziziphus nummularia (Burm. f.) Wight et Arn.



Ziziphus nummularia (Burm. f.) Wight et Arn.



Ziziphus nummularia (Burm. f.) Wight et Arn.



Ziziphus mauritiana Hamilt.

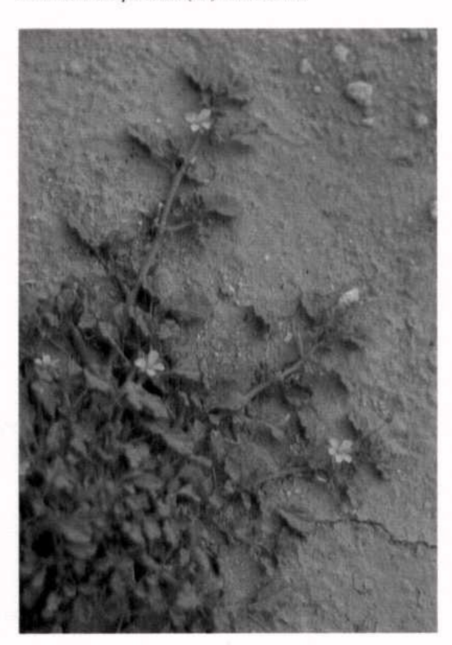


Ziziphus spina-christi (L.) Willd.

PLATE 68



Corchorus depressus (L.) Christens.



Corchorus depressus (L.) Christens.



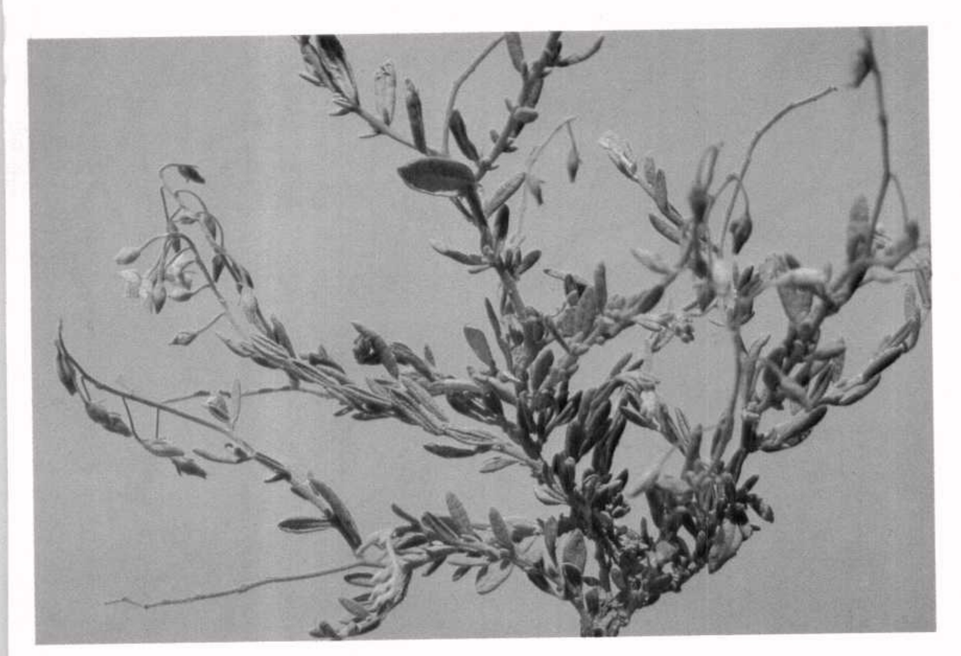
Althea ludwigii L.



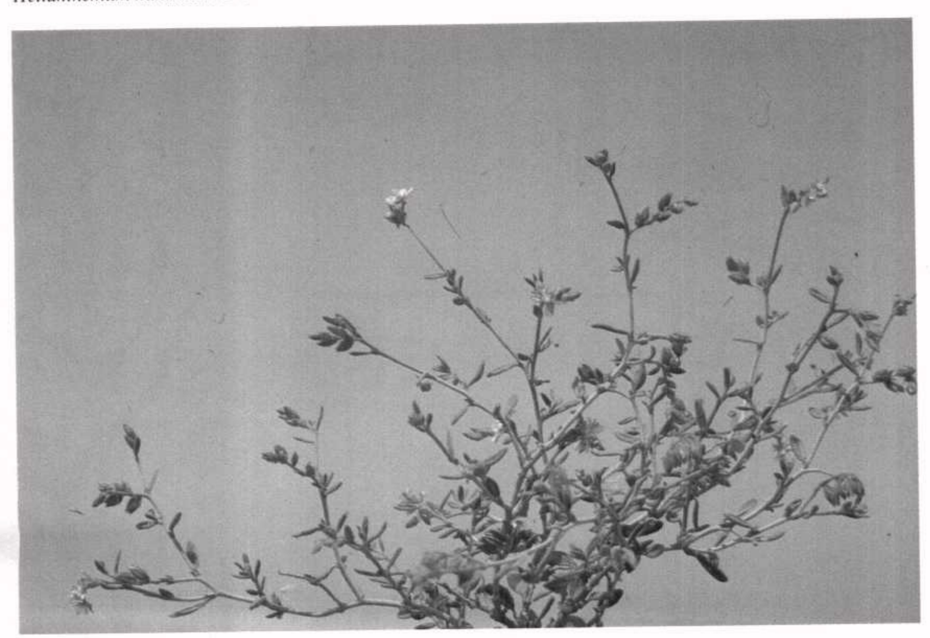
Abutilon fruticosum Guill et Berr.



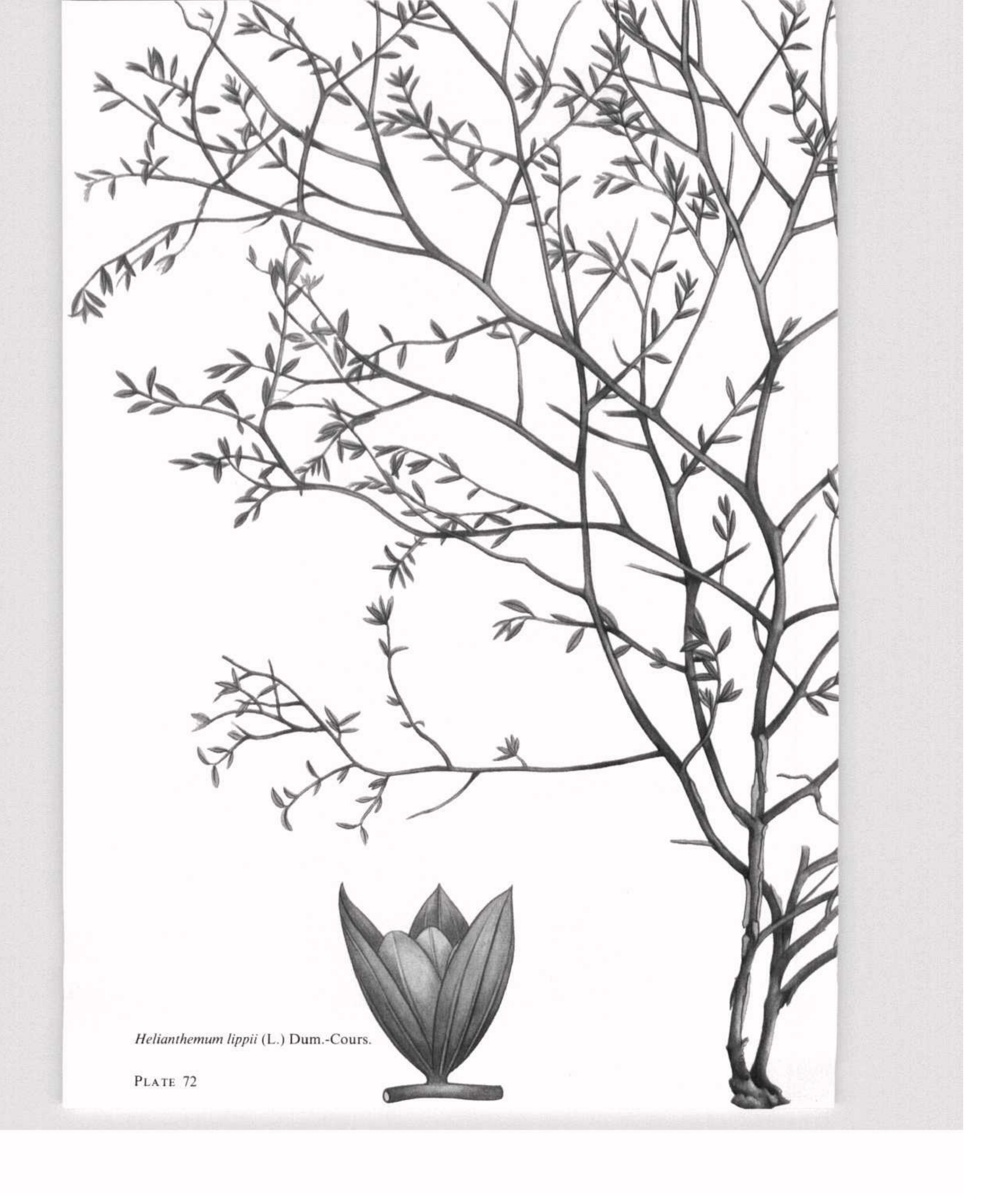
Abutilon pannosum (Forst. f.) Schlecht.



Helianthemum kahiricum Del.



Helianthemum lippii (L.) Dum.-Cours.



Helianthemum lippii (L.) Dum.-Cours.

PLATE 72



Frankenia pulverulenta L.



Citrullus colocynthis Schrad.



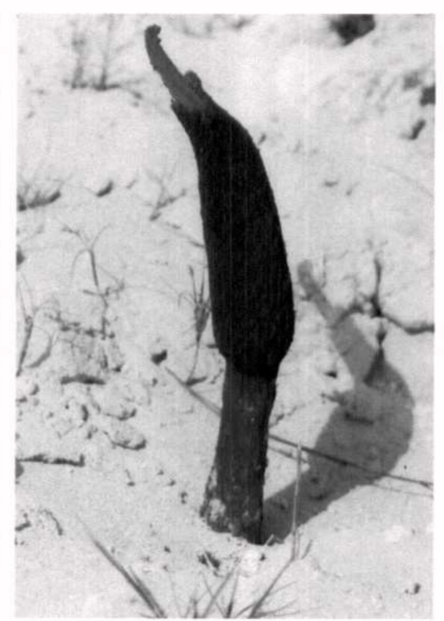
Cucumis prophetarum Jusl.



Citrullus colocynthis Schrad.

Cucumis prophetarum Jussl.

PLATE 74



Cynomorium coccineum L.
(Photo by Dr D. Byrn.)



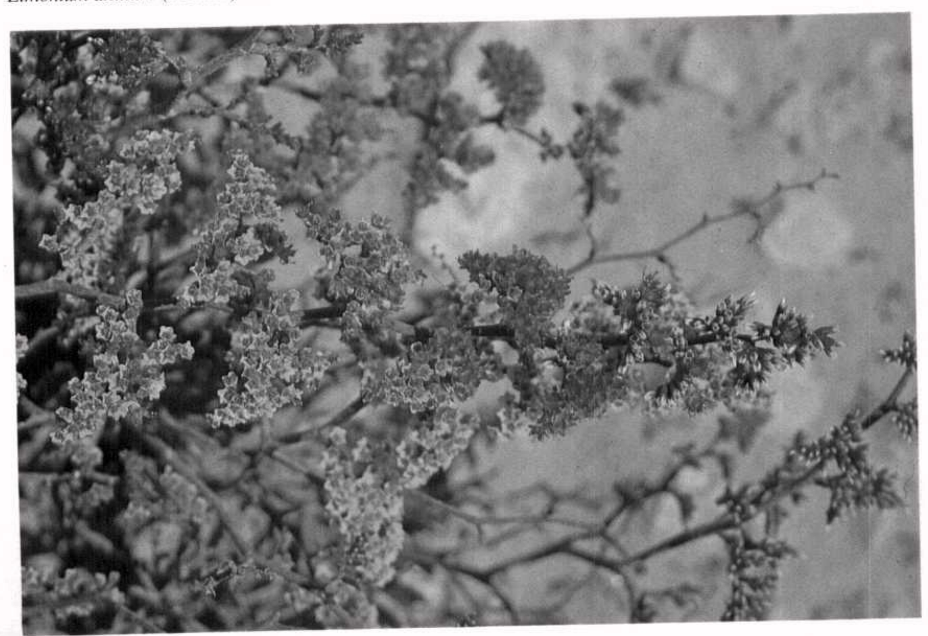
Anethum graveolens L.



Anagallis arvensis L.



Limonium axillare (Forssk.) Kuntze.



Limonium axillare (Forssk.) Kuntze.

PLATE 76

Common in Qatar. The plant exhibits local abundance in narrow runnels and rocky habitats. Its fruits and seeds are edible. Seds are cooked by natives. The plant is known locally as *Itr* and the edible fruits as *Garawah* or *Yarawah*. Flowering from March to April (Plate 77).

2. *LEPTADENIA R. BR.*

Erect shrubs (our species) or twiners. Leaves oposite, small or absent. Flowers small, pale, densely fascicled in small axillary clusters. Fruit glabrous, smooth, linear or oblong.

1. *Leptadenia pyrotechnica* *(Forssk.) Decne.* in Ann. Sci. Nat., Ser. 2, 9: 270 (1838); Täckh., Stud. Fl. Egypt, ed. 2, 416 (1974); Ali, Fl. Lib. 9: 4 (1977); Migahid, Fl. Saudi Arab., ed. 2, 1: 406 (1978). *Cynanchum pyrotechnicum* Forssk., Fl. Aegypt.-Arab. (1775). *Leptadenia spartium* Wight, Contr. Bot. Ind. 48 (1834).

Erect shrub or small tree up to 3 m tall, with numerous slender, spinescent pale green branches. Leaves usually absent. Flowers yellow-green, in small axillary umbellate cymes. Fruit pedicels thick, recurved, carrying a very long (7–12 cm), narrowly linear, pendulous follicle.

The plant is common in southern Qatar. It dominates a community which abounds in depressions and wide runnels receiving wind-deposited sand. Local name: *Markh*, a name used for the same species throughout Arabia and Egypt. Flowering from March to May (Plate 78).

37. *RUBIACEAE A. JUSS.*

Trees, shrubs and herbs (our species). Leaves simple, opposite, decussate or whorled (or sometimes apparently whorled where there are foliaceous stipules), almost always entire. Stipules conspicuous and persistent, leaf-like. Inflorescence cymose. Flowers bisexual, regular. Calyx lobes (3–) 4–5 (–8), sometimes very minute or obsolete. Corolla lobes (3–) 4–5 (–11). Stamens as many as corolla lobes and alternate with them. Ovary inferior, 2-carpelled, 2-loculed; ovules 1 to many in each locule. Fruit a capsule, berry or drupe.

1. *GALIUM L.*

Annual or perennial herbs or undershrubs; stems generally 4-angled. Leaves opposite or in whorls. Flowers small, 3–4 merous; calyx minute or absent; corolla rotate. Bracts and bracteoles absent. Fruit usually of 2 globose nuts.

1. *Galium tricornutum* *Dandy* in Watsonia, 4: 47 (1957); Rech., Fl. Lowland Iraq 566 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 422 (1974); Meikle, Fl. Cyrp. 1: 785 (1977).

G. tricorne Stockes in With., Bot. Arrangement, ed. 2, 1: 153 (1781); Boiss., Fl. Orient. 3: 67 (1875); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 595 (1932).

Climbing annual herb; stems with adhesive retrose bristles, leaves 5–6-whorled linear to narrowly spathulate, 10–25 mm long, 1–3 m wide, longer than the axillary cymes. Flowers

small, corolla white; pedicels up to 5 mm long, minutely spinulose, distinctly recurved in fruit. Fruit 3–4 mm across, slightly scabrous.

It has been recorded only at Al-Megdah, northern Qatar; the plant grows climbing on the dense bushes of *Ziziphus nummularia*. Flowering from March to May.

38. *CONVOLVULACEAE A. JUSS.*

Subshrubs, or perennial herbs, often twining or trailing. Leaves generally simple, alternate. Flowers bisexual, regular or irregular, hypogynous. Calyx 5-sepaled, usually twisted in bud. Stamens 5, inserted near the base of corolla. Ovary 2-loculed, 2–4-ovulate. Styles, bifid, or 2. Fruit a capsule.

I. Style 1, bifid. Stigmas filiform of various habit . . . . 1. *Convolvulus*
II. Styles 2. Stigmas globose. Mat-shaped salt-marsh plant with very small leaves 2. *Cressa*

1. *CONVOLVULUS L.*

Herbs or shrubs, prostrate or erect, or often twining or trailing. Leaves simple, alternate. Pedicels often bracteate, but bracts forming no involucre. Flowers bisexual, regular. Sepals 5, subequal. Corolla funnel-shaped with entire 5-angled or 5-plaited limb and no regular coloured stripes. Stamens 5, inserted on corolla. Ovary 2-loculed, each locule with 2 ovules. Styles filiform with 2 filiform stigmas. Capsule 2-loculed, usually 4-valved, 4-seeded.

I. Twining or creeping plants.
  A. Flowers 1–3 together.
    + Perennial, leaves undivided, peduncles longer than leaves, corolla 6–7 times as the calyx . . . . 1. *C. arvensis*
    + + Annual, leaves cleft, peduncles shorter than leaves, corolla 2 times as the calyx . . . . 4. *C. fatmensis*
  B. Flowers crowded in bracteated heads . . . . 5. *C. glomeratus*
II. Not twining.
  A. Flowers sessile or subsessile . . . . 6. *C. microphyllus*
  B. Flowers on long axillary peduncles.
    + Inflorescence 1·5 cm long, peduncles as long as bracts . 2. *C. cephalopodus*
    + + Inflorescence longer, peduncles longer than bracts.
      a. Sepals lanceolate, short pointed. . . . . 7. *C. pilosellifolius*
      b. Sepals acuminate with a long narrow point . . . 3. *C. deserti*

1. *Convolvulus arvensis* *L.*, Sp. Plant., ed. 1, 153 (1753); Blatter, J. Ind. Bot. Soc. 11: 39 (1932); Rech., Fl. Lowland Iraq 487 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 430, t. 149 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978).

Perennial, prostrate or climbing, glabrous or pubescent. Leaves entire, alternate, varying from cordate–hastate to linear–lanceolate. Peduncles longer than the leaves, solitary or 2–3 together. Pedicels as long as the calyx or longer. Bracts awl-shaped. Sepals round–ovate, scariously margined, glabrous. Corolla white or pink, 2–3 cm long, with red stripes outside. Ovary glabrous.

A very common weed in Qatar; in gardens, lawns, cultivated *rodat*, etc. Flowering throughout the year. Local name: *Olleiq*.

2. *Convolvulus cephalopodus* *Boiss.*, Diagn. Plant. Or. Nov. 1, 7: 24 (1846); Sa'ad, *Convolvulus* sp., Utrecht. 156 (1963).

C. sericeus Burm., Fl. Ind. 49, t. 19, f. 3 (1768), non L. 1767; Boiss., Fl. Orient. 4: 101 (1875); Rech. f., Fl. Iran (*Conv.*) 17 (1963).

C. beluchistanensis Biswas, Journ. Bot. fond. 75: 259 (1937).

C. undulifolius Parsa, Kew Bull. 214 (1948).

A perennial, low-growing herb. Shoots simple, tomentellous. Leaves sessile, radicle ones oblong, cauline ones elliptic; margin plicate, undulate, tomentose, pinnately nerved. Flowers 3–6, in a compact axillary scorpioid cyme. Peduncles as long as the bract. Sepals unequal, tomentose, 7–8 mm long. Corolla white, 15 mm long. Capsule ovoid, hairy from the top, 4 mm long, 3 mm wide, bilocular, 4-seeded; seeds black.

A rare plant in Qatar. This is the first record of this species in Arabia. It has been recorded in Iran and Pakistan. Flowering from February to April (Plate 79).

3. *Convolvulus deserti* *Hochst.* et Steud., Herb. Un. Itin. (1837); Bak. et Rendle, Fl. Tr. Africa 4 (2): 92 (1905); Täckh., Stud. Fl. Egypt, ed. 2, 429 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978).

Perennial herb, branched from the base into numerous simple, 50–70 cm long adpressed-hairy stems. Leaves subsessile, linear–oblong with a tapering base to linear–spathulate, the lower reaching 4 cm long, adpressed hairy on both surfaces; midrib prominent; stem leaves 20–25 mm long, 3 mm wide, usually obtuse. Flowers few, axillary, on 1–2-flowered peduncles. Sepals brown–villous, long pointed. Corolla 14 mm long, with darker, pubescent, mid-petaline area (Plate 79).

Occasional in Qatar. Flowering from March to May.

4. *Convolvulus fatmensis* *Kunze*, Fl. Alleg. Bot. Zeit. 23, 1: 172 (1840); Boiss., Fl. Orient. 4: 109 (1875); Täckh., Stud. Fl. Egypt, ed. 2, 430 (1974) Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978).

Annual trailing herb; pubescent towards the tip. Leaves distinctly petiolate, ovate, obtuse at the apex, cordate at the base with rounded auricles and a broad sinus, deeply and irregularly crenate, thinly pubescent. Flowers 1–2 or short sparsely pubescent axillary peduncles up to 18 mm long, not exceeding the leaves. Flowers 1 cm long. Corolla white with brown stripes, hairy outside. Capsule globose, 5 mm in diameter.

Rare in Qatar; it occurs on fine-textured soil in *rodat*. Flowering from March to April (Plate 80).

5. *Convolvulus glomeratus* *Choisy* in DC., Prodr. 9: 401 (1845); Post, Fl. Syr., Pal. et Sinai., ed. 2, 206 (1933); Täckh., Stud., Fl. Egypt, ed. 2, 430 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978).

Perennial herb, woody at the base, Stems long, slender, trailing or twining, finely hairly. Leaves lanceolate to oblong–lanceolate, 0·5–2·5 cm long, sparsely adpressed-pilose on both surfaces. Flowers in dense, globose bracteate, rust-coloured heads on slender axillary peduncles. Outer bracts foliaceous, up to 1·5 cm long. Corolla 12 mm long,

somewhat exceeding the sepals, pinkish white, pubescent. Capsule globose, glabrous, pale brown.

Rare plant in sandy habitats, particularly central and southern Qatar. Flowering from March to May (Plate 80).

6. *Convolvulus prostratus* *Forssk.*, Fl. Aegypt.-Arab. 203 (1775); Täckh., Stud. Fl. Egypt, ed. 2, 429 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978). *C. microphyllus* Sieber ex Spreng., Syst. Veg. 611 (1825).

Perennial herb, not spinescent, branched from the base into simple, 15–30 cm brown-villous stems. Stem leaves oblong or oblong–lanceolate, generally less than 15 mm long, hairy on both surfaces; radical leaves narrowly spathulate, nearly 25 cm long. Flowers 1–3 together at the upper nodes of the stems, sessile or subsessile. Sepals brown-hispid with a long narrow point. Corolla pinkish-white, funnel-shaped, 6–8 mm long, twice as long as the calyx, hairy outside. Capsule globose.

Fairly common in Qatar. It occurs on gravelly and pebbly soils. Flowering from March to May (Plate 81).

7. *Convolvulus pilosellifolius* *Desr.*, in Lam. Encycl. 3: 551 (1789); Post, Fl. Syr., Pal. et Sinai. 2: 207 (1933); Rech., Fl. Lowland Iraq 486 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 74 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 429 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 429 (1978).

Perennial, tall plants, branching from the base. Branches ascending or prostrate, more or less sparingly adpressed-hirsute, bearing flowering branches from the middle upwards. Leaves pale green, hirsute, margin often repand wavy, the lower leaves oblong–lanceolate, 3–7 cm long, 3–5 mm wide, tapering into a petiole, the upper ones sessile, lanceolate, smaller, acute. Flowers 1–5 together, rose-coloured, on long patent axillary peduncles. Pedicels shorter than the calyx. Sepals hairy, ovate–triangular, short, pointed. Corolla 10–13 mm long, twice to three times as long as the calyx, hairy at angles. Capsule glabrous, ovoid.

Common in Qatar in habitats with deep sandy soil deposited by wind. Flowering from March to May. Local name: *Rokheima* (Plate 82).

2. *CRESSA L.*

A much-branching, low growing, mat-shaped perennial plant. Leaves sessile, small, entire. Flowers white, in short, terminal bracteate spikes. Corolla cleft to over middle in 5 narrow, spreading lobes. Stamens and styles exserted. Ovary 2-loculed, 4-ovuled; styles 2, with capitate stigmas. Capsule 2–4-valved, usually 1-seeded.

1. *Cressa cretica* *L.*, Sp. Plant., ed. 1, 223 (1753); Blatter, Journ. Ind. Bot. Soc. 11: 39 (1932); Rech., Fl. Lowland Iraq 481 (1964); Täckh., Stud, Fl. Egypt, ed. 2, 435, t. 151 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 428 (1978).

Hairy plant of grey appearance, herbaceous or frutescent, prostrate, rarely erect. Leaves 3–6 mm long, crowded, sessile, ovate to lanceolate, acute. Flowers aggregated in dense spikes at the end of branchlets, each subtended by a reduced leaf. Calyx hairy, 2·5

mm long. Corolla white, about 5·5 mm long. Stamens rather longer than the corolla. Capsule ovoid, 2·5 mm long.

Common plant; it grows on salinized land in cultivated localities and coastal as well as inland salines with fine compact soil. Flowering from April to May. Local name: *Nedewah* (Plate 82).

39. *CUSCUTACEAE DUM.*

Leafless annual chlorophyllous parasites, with twining thread-like stems. Flowers in sessile or stalked clusters. Perianth 4–5-fid; stamens 4–5. Fruit a capsule opening irregularly or by circumscission.

1. *CUSCUTA L.*

Leafless annual parasite, with twining stems and small, usually reddish-white flowers in heads or clusters. Calyx 4–5-cleft, corolla tubular or belt-shaped, 4–5-cleft, often urn shaped after flowering. Stamens adnate to the corolla tube, alternating with its lobes. Fruit a capsule.

I. Styles 2 with globose stigmes . . . 1. *C. chinensis*
II. Styles 2 with linear stigmes . . . 2. *C. pedicellata*

1. *Cuscuta chinensis* *Lam.*, Encycl. Meth. Bot. 2: 229 (1786); Rech., Fl. Lowland Iraq 489 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 435 (1974).

Annual parasite. Stem thin, yellow, richly branched. Flowers shortly stalked, 2–3·5 mm long, in dense clusters. Calyx lobes triangular–ovate, thickened and fleshy towards the tips. Corolla spreading, often with infexed tips. Stamens shorter than the lobes. Capsule globose, opening by circumscision.

The plant is fairly common in Qatar; parasitizing on Alfalfa, *Ziziphus nummularia* and *Ocimum basilicum*. Flowering all the year round.

2. *Cuscuta pedicellata* *Ledeb.*, Fl. Atl. 1: 293, Icon. Tab. 234 (1829); Rech., Fl. Lowland Iraq 490 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 436, t. 151 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 439 (1978).

C. arabica Fres., Mus. Senck. 1: 165 (1833); Buiss., Fl. Orient. 4: 120 (1879).

Annual parasite, with yellow, richly branched, thin stems, less than 1 mm in diameter. Flowers small, 1·5 mm long, subsessile or on pedicels equalling the flowers, in umbellate clusters of 3–8 flowers. Perianth 4-fid. Styles of 2 small tubercles, each ending in a subulate stigma. Capsule globose-depresed.

Rare in Qatar, parasitizing on various hosts; particularly Alfalfa.

40. *BORAGINACEAE A. JUSS.*

Subshrubs, or annual or perennial herbs, usually rough hairy herbs, with mucilagenous juice. Leaves mostly alternate, undivided. Flowers regular, rarely 2-lipped, in scorpioid

cymes. Calyx 5-cleft or -parted. Corolla 5-lobed, regularly or irregularly lobed. Stamens 5, epipetalous. Ovary 2-loculed, but divided by false septa into 4 1-seeded nutlets, style gynobasic.

I. Small undershrubs, fruit dry, 2–4 nutlets . . 5. *Heliotropium*
II. Annual or perennial herbs.
  A. Corolla irregular.
    1. Stamens projecting . . . . . . 3. *Echium*
    2. Stamens not projecting, branches white 2. *Echiochilon*
  B. Corolla regular.
    1. Perennials . . . . 7. *Moltkiopsis*
    2. Annuals.
      a. Fruit spiny . . . . 6 *Lappula*
      b. Fruit unarmed.
        + Flowers yellow . . . . . 1. *Arnebia*
        + + Flowers violet . . . . . 4. *Gastrocotyle*

1. *ARNEBIA FORSSK.*

Small, mostly annual hispid herbs, with alternate stem-leaves. Roots coloured. Flowers small, regular, yellow or purple, arranged in scorpioid bracteate spikes or racemes. Calyx deeply 5-lobed. Corolla tube cylindrical with 5 patent lobes; throat naked. Stamens epipetalous, with short filaments. Ovary with 4 distinct lobes inserted on the narrow gynobase. Nutlets 4, ovoid, rugose.

1. *Arnebia hispidissima* *(Lehm.) DC.*, Prodr. 10: 94 (1846); Boiss., Fl. Orient. 4: 213 (1879); Blatter, J. Ind. Bot. Soc. 11: 39 (1932); Täckh., Stud. Fl. Egypt, ed. 2, 450 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 443 (1978).

Annual or biennial, densely white bristly herb, 10–30 cm high, often richly branched. Roots coloured. Leaves lanceolate to linear, spreadingly hairy with white bulbous-based bristles. Flowers small, yellow, arranged in one-sided, dense cymes. Calyx lobes narrowly lanceolate, not growing in fruit, 5 mm long. Corolla yellow, with a tube 1–2 cm long. Stigma flattened. Nutlets minute, tubercled.

Common in Qatar, the plant grows on sandy soil in depressions. Flowering from December to April. Local name: *Melleih* (Plate 83).

2. *ECHIOCHILON DESF.*

Suffrutescent low plant with white rigid stems. Leaves hispid. Flowers in leafy inflorescences. Corolla 2-lipped, whitish. Nutlets ovoid, glabrous.

1. *Echiochilon kotschyi* *(Boiss. et Hohen.) I. M. Johnst.*, J. Arnold Arb. 38: 283 (1957); Reidl in Rech., Fl. Iran. 48: 57 (1967).

Lithospermum kotschyi Boiss. et Hohen. in Boiss., Diagn. Plant. Orient. Nov. Ser. 1, 4: 49 (1844). *Sericostoma kotschyi* (Boiss. et Hohen.) Franch. in Revoil, Fauna et Flore Pays Comalis (Sertulum Somalense) 46 (1882).

Suffrutescent with rigid stems, 20 cm high. Leaves 2–5 mm long, 0·8–1·2 mm broad, recurved. Flowers in leaf axils, white with yellow tinge. Calyx 4 mm long. Corolla 5–6 mm

long, more or less zygomorphic; limb *ca.* 4–5 mm in diameter. Style 1·5–1·7 mm long; stigma bilobed. Nutlets 2–2·5 mm long.

Rare in Qatar. Usually found in northern Qatar on hard compact calcareous soil. Flowering from February to April (Plate 84).

3. *ECHIUM L.*

Herbs with large irregular flowers in terminal simple or brached cymes. Sepals 5, linear to lanceolate; corolla funnel-shaped, curved with open throat and obliquely cut limb. Stamens 5, inserted below middle of tube; styule bifid; nutlets ovoid, rugose.

1. ***Echium horridum*** *Batt.*, Täckh., Stud. Fl. Egypt, ed. 2, 451 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 441 (1978).

Erect annual plant, densely beset with white, bulbous-based bristles. Leaves narrow, nut ovate, and not silvery grey. Corolla 20 mm long, violet, fruit calyx 2 cm long. Corolla longer than broad.

Rare in Qatar; in sandy habitats in southern Qatar.

4. *GASTROCOTYLE BUNGE*

Prostrate herbs, annual or perennial with long narrow, dentate leaves. Flowers solitary in the leaf axils, violet, not longer than calyx, with throat.

1. ***Gastrocotyle hispida*** *(Forssk.) Bunge*, Rel. Lehm. 405 (229) (1847); Rech., Fl. Lowland Iraq 502 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 75 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 448 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 443 (1978).

Anchusa hispida Forssk., Fl. Aegypt.-Arab. 40 (1775); Boiss., Fl. Orient. 4: 158 (1879).

Annual prostrate herb, rough with unequal bristles arising from a tubercle. Leaves narrow, wavy margined, lanceolate, the lower long-petioled. Flowers solitary in axils, minute, with short pedicels. Calyx teeth whitish bristly barbed, especially at the magins, 2 mm long. Corolla small, violet, not longer than the calyx. Nutlets with an acute-angled beak.

Fairly common plant in Qatar. It grows in shallow depressions with fine sediments. Flowering from April to May. Local name: *Rims* (Plate 84).

5. *HELIOTROPIUM L.*

Annual or perennial herbs or small shrublets (ours). Flowers small, white in our species, sessile in leafless scorpioid, usually one-sided cymes. Calyx 5-parted, persistent or deciduous with the fruit. Corolla funnel- or salver-shaped, with 5-lobed or -parted limb. Anthers nearly sessile. Style simple, terminal on the top of the fruit. Ovary at maturity breaking up into 4 distinct nutlets or fewer by abortion.

1. ***Heliotropium bacciferum*** *Forssk.*, Fl. Aegypt.-Arab. 38 (1775); Rech., Fl. Lowland Iraq 497 (1964); Riedl in Rech., Fl. Iran. 48: 19 (1967); Täckh., Stud. Fl. Egypt, ed. 2, 441 (1974).

Low shrub with erect, ascendent or procumbent stems. Stems and leaves beset with

more or less appressed hairs, greyish. Leaves sessile, either 10 mm long and 1–1·5 mm broad or subplane 35 mm long and 5–7 mm broad, margin revolute with inconspicuous nerves. Racernes dense. Calyx 2·5 mm long, persistent. Corolla tube as long as the calyx or little longer, hairy outside, lobes outspread, rounded, imbricate in bud. Nutlets 4, with long silky hairs, more or less glabrescent, connate in pairs.

This species is represented in Qatar by 2 subspecies (*cf.* Riedl, Oesterr. Bot. Zeitschr. 113: 167 (1966)).

a. Subsp. ***bacciferum***. Riedl in Rech., Fl. Iran. 48: 20 (1967).
Leaves 10–35 (–40) mm long, 7 mm broad.

b. Subsp ***tuberculosum*** (Boiss.) Riedl, Oesterr. Bot. Zeitschr. 113: 167 (1966). *Heliotropium tuberculosum* Boiss., Fl. Orient. 4: 147 (1879). *H. undulatum* Vohl. var *tuberculosum* Boiss., Diagn. Plant. Orient. Nov. Ser. 1, 11: 89 (1849). *H. kotschyi* Bunge, Rel. Lehm. 404 (1851).

Leaves 10 (–20) mm long, 2–3 mm broad, densely hispid with bulbous-based calcareous bristles.

Subspecies *bacciferum* is common in shallow depressions, while subsp. *tuberculosum* is common on fine-textured, slightly compact saline soils. Flowering is mainly in the spring (Plate 85).

6. *LAPPULA GILIB*

Annual herbs with linear to linear–spathulate leaves. Flowers in a lax, leafy cyme, regular, blue or white, hardly longer than the calyx. Calyx 5-parted, cleft to the base. Stamens 5, included. Nutlets spiny or spiny-tubercled, closely attached to each other, forming a pyramidal body with exserted style at the tip.

1. *Lappula spinocarpos* *(Forssk.) Aschers.*, in Sitzungsber. Bot. Ver. Brand. 16: 88 (1874); Zohary, Pal. Journ. Bot., Jer. Ser. 1, 3: 251 (1939) et Proc. Linn. Soc., Lond. 153 sess. 106 (1940–41); Rech., Fl. Lowland Iraq 500 (1964); Halwagy et Macksad, Bot. J. Linn. Soc. 65: 75 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 445 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 443 (1978).

Echinospermum spinocarpos (Forssk.) Boiss. Fl. Orient. 4: 249 (1879). *Sclerocaryopsis spinocarpos* (Forssk.) Brand. in Engler, Pflanzenr. 4, 252: 98 (1931).

A richly branched stiff annual, 5–10 cm high. Stems branching from the base. Leaves linear–spathulate, convolute. Racemes loose. Bracts linear, longer than the fruit. Pedicels very short. Calyx about 4·5 mm long. Corolla shorter than the calyx, about 4 mm long, with white tube and bluish limb. Calyx accrescent in fruit, up to 7 mm long, twice as long as fruit. Fruits glossy, spiny, on short, erect pedicels.

Occasional on gravelly and shallow fine soil. Flowering from February to April (Plate 86).

7. *MOLTKIOPSIS JOHNST.*

Perennial herbs with a white bark on the older stems, leaves linear–lanceolate. Flowers small, regular, blue or white, in cymes which are leafy (bracteate to the top). Calyx

5-parted. Corolla funnel-shaped, much longer than the calyx, with short, erect lobes and naked throat. Style exserted.

1. *Moltkiopsis ciliata* *(Forssk.) Johnst.*, J. Arnold Arb. 34: 6 (1953); Rech., Fl. Lowland Iraq 508 (1964); Halwagy et Macksad, Bot. J. Linn. Soc. 65: 75 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 449 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 442 (1979).

Lithospermum callosum Vahl., Symb. Bot. 1: 14 (1749); Boiss., Fl. Orient. 4: 215 (1879). *Moltkia callosa* (Vahl.) Wettst. *M. ciliata* Maire.

Small shrub, 10–20 cm high, with white, angled branches. Leaves 10–20 mm long, 4–5 mm wide, linear–lanceolate, densely spiny-hispid of bulbous-based bristles. Flowers crowded towards the top of the branches, blue with exserted long pink tube. Nutlets about 1 mm long, ovate–triangular.

Common on sandy soil deposited by wind in southern Qatar, and on the sand accumulations between Dukhan and Umm Bab. Flowering from March to May. Local name: *Ghabsha* and *Halama* (Plate 86).

41. *VERBENACEAE JAUME ST-HILAIRE*

Herbs or shrubs. Leaves simple or compound, exstipulate, opposite or whorled. Inflorescences racemose or cymose, often with involucre of coloured bracts. Flowers bisexual, zygomorphic. Calyx 4–5-toothed or -partite, persistent. Corolla 2-lipped or irregular. Stamens 4, didynamous. Ovary of 2, later 4 locules. Terminal style with 1 stigma.

1. *LIPPIA L.*

Mat-shaped rooting herb. Leaves opposite, simple, serrate. Flowers minute, pinkish, in ovate, at length oblong–cylindrical, axillary, peduncled heads. Calyx small, membranous. Corolla funnel-shaped. Fruit a dry drupe.

1. *Lippia nodiflora* *(L.) Michx.*, Fl. Bor. Amer. 2: 15 (1803); Rech., Fl. Lowland Iraq 514 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 452, t. 156 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 461 (1978).

Phyla nodiflora (L.) Greene, Pitonia 4: 46 (1899).

Perennial, procumbent herb, rooting at nodes. Leaves simple, cuneate–spathulate, tapering into a short petiole, entire below, acutely serrate above, with prominent nerves. Flowers in ovate, at length oblong–cylindrical spikes, on axillary, solitary peduncles. Peduncles longer than the leaves. Corolla pinkish, 5–6 mm long. Drupe ovate.

Rare in Qatar, recorded in the shade of a palm tree, where water is spilled continuously from a tap at Ras Ushirij. Flowering from May to September (Plate 88).

42. *AVICENNIACEAE (END.) SCHNIZL.*

Shrubs or trees of mangrove habit, often greyish tomentose. Leaves simple, opposite,

entire, exstipulate. Flowers small, yellow, regular, bisexual. Calyx 5-lobed; corolla 4-lobed, stamens 4. Fruit a broad, compressed, ovoid or spherical, bivalved, 1-seeded capsule.

1. *AVICENNIA L.*

Evergreen tree or shrub with opposite, entire, leathery leaves, dark green above, white or grey-wooly beneath. Flowers in small, short-peduncled clusters. Calyx tube short, 5-parted into ovate lobes. Corolla tube short, cylindrical, limb spreading, 4-cleft. Stamens 4. Ovary of 4 1-ovuled locules, style short, bifid. Fruit a large capsule, somewhat fleshy, dehiscent by 2 valves, rounded–compressed. By abortion fruit 1-seeded. Embryo germinating within its pericarp on mother plants (viviparous).

1. *Avicennia marina* *(Forssk.) Vierh.* Täckh., Stud. Fl. Egypt, ed. 2, 454 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 461 (1972).

A. officinalis L., Sp. Plant., ed. 1, 110 (1753); Post, Fl. Syr., Pal. et Sinai 2: 323 (1933).

Tree or large shrub with elliptical, entire, opposite, leathery leaves tapering into a short petiole. Leaves green on the upper surface, snowy white on the lower. Inflorescence dense capitate, terminal on the branches or in their upper leaf axils, 2 or 3 together. Flowers sessile, each with a bract and 2 ovate bracteoles which are silky on the outer surface and shorter than the calyx. Stamens hardly exerted.

Mangrove tree confined to the eastern coast of Qatar opposite Dhakhira, on muddy flats of shallow water. Local name: *Girm*.

43. *LABIATAE A. JUSS.*

Herbs or shrubs, with 4-angled stems, and with opposite or whorled, aromatic leaves. Flowers axillary, usually in cymose clusters these often aggregated in terminal heads, spikes, or racemes, rarely one or two flowers in the axils. Flowers bisexual, 2-lipped. Calyx 5-toothed. Corolla 2-lipped. Stamens 4, didynamous, rarely reduced to 2, epipetalous. Ovary 2-carpelled, each with 2 ovules. Style single, bifid above. Fruit with 4 nutlets.

I. Flowers in axillary whorls, corolla with 2 distinct lips . . . . . 1. *Salvia*
II. Flowers in heads, corolla with only lower lip developed . . . . 2. *Teucrium*

1. *SALVIA L.*

Perennial herbs or shrubs with simple leaves. Flower whorls in simple or branched spikes, white or pink, rarely bluish. Calyx more or less distinctly bilabiate. Corolla with 2 distinct lips. Stamens 2.

1. *Salvia aegyptiaca* *L.*, Sp. Plant. 23 (1753); Boiss., Fl. Orient. 4: 631 (188); Zohary, Proc. Linn. Soc. Lond. 153 sess. 106 (1940–41); Rech., Fl. Lowland Iraq 527 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 462 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 464 (1978).

Low undershrub, intricately branched; branches stiff, almost spinescent. Lower leaves few, short-petiolate, oblong–linear to linear, the upper ones smaller, sessile, with revolute

margin, obtuse. Floral leaves minute, persistent, ovate, acute. Flowers in remote whorls of 2 to 4 flowers. Calyx about 3 mm long in flower, 5–4 mm long in fruit. Corolla whitish, about 4 mm long.

Very common in Qatar, on coarse and fine textured soils in various habitats, particularly depressions. Flowering from March to June. Local name: *Noaim* (Plate 87).

1. *TEUCRIUM* L.

Perennial herbs or suffrutescent at base, with simple or divided leaves. Inflorescence racemose or head-like, terminal. Calyx 5-toothed. Corolla white, pale mauve or greenish yellow, deciduous, with all the 5 lobes joined into a lower limb. Stamens 4, didynamous, exserted. Style bifid.

1. *Teucrium polium* *L.* var. *Pilosum* Decne (1834). *T. pilosum* (Decne) *Ascher.* and *Schweinf.* (1887).

Perennial, woody at base, white fleecy. Stems and branches erect or ascending, rigid, branched at base, shortly panicled or often corymbose. Leaves sessile, oblong or linear, crenate. Flowers many together, in dense spherical, long-peduncled heads. Corolla white.

Common plant in central and northern Qatar. It grows in narrow runnels with stony shallow soil. Flowering from May to July. Local name: *Jaad* or *Ya'ad.*

The plant is reputed for its medicinal value in folk medicine. The boiled leaves are used as a cooling draught in fever (Plates 88, 89).

44. *SOLANACEAE* A. JUSS.

Herbs or shrubs, usually narcotic and poisonous. Leaves alternate, sometimes clustered in the axils (*Lycium*), or the upper ones opposite (*Withania*), without stipules. Flowers bisexual, regular. Calyx 5-cleft or 5-partite, persistent or with persistent base. Corolla 5-lobed. Stamens 5, inserted on the corolla tube. Ovary 2-loculed, with numerous ovules on obliquely placed placentae. Fruit a berry or capsule.

I. Shrubs with twigs transformed into thorns . . . . 1. *Lycium*
II. Not so
  1. Fruit calyx inflated, enclosing the fruit; flowers solitary . . . . 2. *Physalis*
  2. Fruit exposed; flowers in terminal, few-flowered, umbellate corymbs 3. *Solanum*

1 *LYCIUM* L.

Thorny shrubs with simple, entire, narrow spathulate leaves, clustered together with the long-peduncled flowers in the leaf axils. Calyx cup-shaped or tubular, not accrescent in fruit. Corolla elongated tubular with spreading limb, white or violet. Fruit a globose, many-seeded berry.

1. *Lycium shawii* *Roem. et Schult.*, Syst. Veg. 4: 693 (1819); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 76 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 476, t. 165 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 491, t. 495 (1978).

L. arabicum Schweinf. ex Boiss., Fl. Orient. 4: 289 (1879).

Rigid, shrubby, thorny plants, 1–3 m high. Leaves much varying in size, together with the young branches pubescent, more seldom glabrous, spathulate–oblong. Flowers long-peduncled, with the calyx one-fourth as long as the corolla. Corolla elongated. Berries red, edible, of pea-size.

Very common in Qatar; on the *hozoom* and in the different types of *rodat*. Flowering almost all the year. Local name.: *Awsaj*, a name used in other Arab countries for the different *Lycium* species (Plates 90, 91).

2. *PHYSALIS* L.

Herbs with broad leaves. Flowers solitary. Fruit calyx inflated hiding the berry.

1. *Physalis angulata* L., Sp. Plant. 183 (1753); Täckh., Stud. Fl. Egypt, ed. 2, 476 (1974).

Annual herb, hairy to almost glabrous, up to 60 cm. Leaves petioled, ovate, acute, coarsely serrate, up to 7 cm long, 5 cm broad. Flowers small, yellow, tinged with brown at base of the tube, anthers blue. Berry green, later turning yellow, edible.

Rare in Qatar; recorded only in a garden at Doha as a weed among cultivated plants. Collected plants were flowering in May.

3. *SOLANUM* L.

Annual or perennial herbs with simple, entire or sinuate–dentate leaves. Calyx campanulate, 5-lobed, scarcely accrescent in fruit. Corolla rotate, with a short tube, the limb deeply divided into 5 oblong–lanceolate lobes. Stamens inserted on the throat of the corolla tube; the filaments short, the anthers long, exserted, connivent or coherent into a cone, opening by two apical pores. Fruit a globose, many-seeded berry.

I. Annual herbs without spines. Leaves dark green 2. *S. nigrum*
II. Perennial herbs with spines. Plant silvery . . 1. *S. elaegnifolium*

1. *Solanum elaegnifolium* *Cav.*, Icon. Descr. 3: 22, tab. 243 (1795); Täckh., Stud. Fl. Egypt, ed. 2, 474 (1974).

A perennial herb of silvery aspect. Leaves lanceolate, wavy-margined, beset with short spines (in our specimens no spines on the leaves, but on the stems only). The spines are small. Flowers violet, in cymes. Fruit a berry, globose, about 7 mm across, yellow.

Rare weed in Qatar. It has been recorded in a garden at Al-Wabrah and in the government farm, northern Qatar. Flowering from April to June. Fruits were collected from September to December (Plate 92).

2. *Solanum nigrum* L., Sp. Plant., ed. 1, 186 (1753); Rech., Fl. Lowland Iraq 536 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 473, t. 163 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 491, t. 497 (1978).

Annual, 30–60 cm, glabrous or pubescent. Stems branched from the base, the branches angled. Leaves ovate–deltoid, entire or shallowly sinuate–dentate, acute, tapering into a petiole shorter than the decurrent blade. Flowering in 3–6-flowered, umbellate, short-peduncled corymbs, the pedicels erect in flower, reflexed and thickened at tip in

fruit. Corolla white, twice as long as the calyx, the lobes spreading at first, then revolute. Berries globose, about 8 mm in diameter, black.

The species is represented in Qatar by var. *humile* (*Bernh.*) Asch. (1864) (*Solanum humile* Bernh. in Willd. 1809) with a red or yellow berry.

Occasional weed in regularly irrigated localities. It has been collected from a locality where sewage is spilled in the desert east of Dukhan. Flowering from February to May. In some Arab countries, the plant is known as *Enab ed Deeb*. The fruit is edible.

45. *SCROPHULARIACEAE A. JUSS.*

Herbs or shrubs, some are parasites or semi-parasites, some are climbers or twiners. Leaves simple to pinnately-parted, alternate or opposite or whorled. Flowers either solitary or in terminal or lateral spikes or racemes. Flowers bisexual, zygomorphic, hypogynous, pentamerous, with reduction of carpels and sometimes also of stamens to 2. Calyx deeply cleft, corolla of united petals, sometimes forming 2 lips, sometimes spured or pouched on the anterior side. Stamens rarely 5, often 4, didynamous, with the rudiment of the fifth present. Ovary bilocular, with numerous ovules on axile placenta. Fruit usually a capsule with numerous small seeds.

I. Shrubby desert perennial . . . . 2. *Scrophularia*
II. Not so.
  a. Corolla tubular, bilabiate, stamens 4 1. *Antirrhinum*
  b. Corolla rotate, stamens 2 . . . 3. *Veronica*

1. *ANTIRRHINUM L.*

Annual, dwarf herb (ours) with simple, entire leaves. Flowers in a spike-like raceme. Calyx 5-parted. Corolla closed, 2-lipped, saccate at base. Stamens 4, didynamous, included on the corolla. Capsule with 2 unequal locules, many-seeded, opening by pores.

1. *Antirrhinum orontium* *L.*, Sp. Plant., 617 (1753); Post, Fl. Syr., Pal. et Sinai 2: 290 (1933); Täckh., Stud. Fl. Egypt, ed. 2, 491 (1974). *Misopates orontium* (L.) Rafin.

Annual dwarf herb. Leaves sessile. Flowers solitary, sessile in the leaf axils. Calyx lobes narrow, as long as or longer than the corolla. Corolla rose-coloured, rarely white. Capsule obliquely ovoid.

Rare in Qatar; it grows as weed in cultivated land. Flowering in the spring.

2. *SCROPHULARIA L.*

Perennial herbs or shrubs or annuals with opposite, simple or pinnatisect leaves. Flowers in cymes in the axils of the upper leaves or bracts. Calyx 5-parted. Corolla bilabiate with almost globular tube. Stamens 4, didynamous, rudimentary 1 forms a scale-like appendage between the uppermost lobes of the corolla. Capsule 2-loculed, many-seeded, septicidal.

1. *Scrophularia deserti* *Del.*, Fl. aegypt. Ill. 96, t. 33, f. 1 (1813); Boiss., Fl. Orient. 4: 414

(1879); Rech., Fl. Lowland Iraq 548 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 76 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 403, t. 172 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 507 (1978).

Shrubby perennial with frutescent base, glabrous except the minutely glandular inflorescence. Leaves deeply cleft or parted, with obtuse, often white-margined lobes. Upper stem leaves sessile. Flowers in short-peduncled, bifid, many-flowered cymes, the branches elongate, rigid, loose. Calyx 1–1·5 mm long. Corolla twice as long as calyx, tinted in deep red and pink. Capsule small, equal or at most twice as long as calyx.

Occasional in Qatar. The plant grows on fine-textured soil among the rocks and stone fragments as well as in runnels. Flowering from March to May (Plate 92).

3. *VERONICA* L.

Annual or perennial herbs, with opposite leaves. Flowers blue, pink or white, in opposite, panicled racemes, or solitary in the axils. Calyx 4–5-parted. Corolla rotate or funnel-shaped with 4 almost equal lobes. Stamens 2, inserted on the tube, exserted. Capsule turgid, compressed, 2-loculed, few-seeded.

1. ***Veronica cymbalaria*** *Bod.*, Diss. 3 (1798); Boiss., Fl. Orient. 4: 467 (1879); Post, Fl. Syr., Pal. et Sinai 2: 306 (1933); Blatt., Fl. Arab. 3: 349 (1921).

Annual herb. Leaves semi-orbicular, subcordate or cuneate at base, petioled, 5–11-crenate-lobed. Peduncles longer than leaves, spreading. Calyx-lobes ovate to elliptical, open in fruit, ciliate. Corolla white, rotate. Capsule inflated, 2–4-seeded; style longer than sinus; seeds urn-shaped.

A rare weed. Flowering from February to April.

46. *ACANTHACEAE* A. JUSS.

Herbs or shrubs, with simple, opposite–decussate, exstipulate leaves. Inflorescence often a cyme dichasium passing into monochasium above and forming short axillary clusters; spicate and racemose inflorescence are also found. Bracts and bracteoles well-developed and often brightly coloured. Flowers bisexual, medianly zygomorphic, hypogynous, pentamerous with generally a reduction to 4 or 2 in stamens and to 2 carpels. Calyx deeply 5-partite, sometimes 4- or 3-partite. Corolla often bilabiate. 1 or 2 staminodes are often present. Fruit a loculicidal capsule, with generally 4 to many seeds.

1. *BLEPHARIS* A. JUSS.

Thistle-like spiny, frutescent herb, with blue flowers in a dense, bracteate, terminal spike. Bracts large prickly. Calyx 4-parted. Corolla tube short, ovoid, constricted at apex, limb short, cup-shaped at base, 3–5-lobed at apex. Stamens shorter than corolla-lips, inserted at the base of the corolla, filaments thickened incurved, anther connivent in pairs, 1-lobed. Style bifid at tip. Capsule 4- or by abortion 2-seeded.

1. ***Blepharis ciliaris*** *(L.) B. L. Burtt*; Täckh., Stud. Fl. Egypt, ed. 2, 502 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 516 (1978).

B. persica (Burm. f.) Kuntze., Revis. Gen. 483 (1891).

B. edulis (Forssk.) Pers., Syn Pl. 2: 180 (1807).

Perennial thistle-like spiny herb. Leaves and bracts rigid of silvery appearance, 4-rowed, patent, recurved, spiny-tipped and prickly-toothed. Flowers 2 cm long. Calyx 4-parted of 2 large and 2 small sepals. Corolla bluish, 3-lobed, with a small tooth on each side. Capsule flattened, ovate, tapering, 1 cm long.

Occasional in Qatar. The plant grows in stony and gravelly habitats, e.g. the ***hozoom*** and shallow runnels crossing them. Flowering almost in all seasons. Arabic name: ***Shawk-ul-Dab***. (Plate 93).

Obeid (1975) recorded ***Astercantha longifolia*** (*L.*) *Nees*, Wall. Pl. Asi. Rat. 3: 90 (1832) et Icon 2: t. 449.

Hygrophila auriculata (Schumach) Heine, Kew Bull. 1612: 172 (1962) at Umm Bab. It has not been recorded by the present author and it seems that the specimen collected by Obeid was introduced in the gardens. A specimen of this plant collected by Obeid has been examined by the present author in Cairo University Herbarium.

This species is a robust annual herb, with purple-blue flowers. It grows in Tropical Africa, Sri Lanka and India (Bhandri, Fl. Indian Desert, 1978).

47. *OROBANCHACEAE VENT.*

Succulent root-parasitic, annual or perennial herbs, without chlorophyll. Leaves reduced to scale-like, alternate, yellowish to purplish. Flowers in dense terminal bracteate spikes or racemes. Calyx persistent, tubular below, 4–5-toothed or -lobed above. Corolla sympetalous, with a somewhat curved tube, and a 5-lobed, or more or less 2-lipped limb. Stamens 4, epipetalous, didynamous. Ovary superior, with numerous ovules on 4 parietal placentae. Fruit a 1-loculed, 2-valved capsule; seeds minute.

1. *CISTANCHE HOFFMGG ET LINK*

Perennial root parasites with simple fleshy stems. Flowers yellow, blue or purple, bracted with a median bract at the base and 2 lateral bracteoles. Calyx 4–5-fid. Corolla with a curved tube. Stamens 4, didynamous. Capsule 1-loculed, 2-valved, crowned at apex with base of persistent style.

1. ***Cistanche phelypaea*** *(L.) Cout.* (1913); Täckh., Stud. Fl. Egypt, ed. 2, 509 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 521, tt. 524, 525 (1978).

C. lutea (Dorf.) Hoffmgg et Link, Fl. Port. 1: 319, t. 63 (1806); Post, Fl. Syr., Pal. et Sinai 2: 312 (1933).

C. tinctoria (Forssk.) G. Beck.

Large robust, perennial, root parasite, 30–60 cm high. Stem fleshy, 1–1·5 cm thick covered with oblong–lanceolate scales, 3 cm long. Spike thick, dense bearing ovate–obtuse bracts, 1 cm long, as long as the calyx or longer, bracteoles oblong, shorter than the

calyx. Flowers 4–6 cm long, yellow. Calyx campanulate with acute, scarious-margined lobes. Corolla tube curved in the middle. Fruit ovoid.

Very common in the littoral salt marshes in Qatar, on *Limonium axillare* and *Arthrocnemum glaucum*. Flowering from March to May. Local name: *Dhanoun* (Plate 93).

48. *PLANTAGINACEAE* A. JUSS.

Mostly herbs with rosetted leaves and scape, or with distinct stem and opposite leaves. Flowers regular, 4-merous, in spikes. Calyx persistent. Corolla scarious. Stamens 4. Ovary 1–4-loculed, with central placenta. Fruit a capsule.

1. *PLANTAGO* L.

Herbs (ours) or shrubby plants. Flowers spiked or capitate subtended by bracts. Sepals 4. Corolla tubular, limb at length reflexed. Fruit a capsule opening by a lid.

I. Plant with distinct stem and opposite leaves	6. *P. psyllium*
II. Stemless with scapes arising from a leaf rosette, or sometimes a short stem but then leaves alternate.	
A. Leaves pinnatifid, at least with a few lobes	3. *P. coronopus*
B. Leaves undivided, with entire, rarely minutely dentate margin.	
1. Bracts with black centre, plant turning black when dry	1. *P. amplexicaulis*
2. Bracts pale, plant keeping green.	
a. Scape and leaves thinly pilose to glabrous . . .	4. *P. lanceolata*
b. Scape and leaves densely pubescent to villous.	
+ Petals densely ciliated by long hair. . . .	2. *P. ciliata*
+ + Petals glabrous	5. *P. ovata*

1. *Plantago amplexicaulis* *Cav.* Ic. Descr. 2: 22, t. 125 (1793); Rech., Fl. Lowland Iraq 556 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 514 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 523 (1978).

Annual, sparingly-hairy, stemless or with a short but conspicuous stem. Leaves lanceolate, clasping at base. Peduncles axillary, longer than leaves. Spikes ovate–cylindrical. Bracts glabrous, broadly scarious-margined, with black mid-rib. Sepals glabrous, broad–ovate, the anterior one with a herbaceous keel, ovate, the posterior scarious at all. Corolla lobes ovate–oblong, acute. Capsule elliptic, 6 mm long.

Common in Qatar, particularly north of Doha. It flourishes on fine deposits in depressions. Flowering from March to April (Plate 94).

2. *Plantago ciliata* *Desf.*, Fl. Atlant. 1: 137, tab. 39, f. 3 (1769); Boiss., Fl. Orient. 4: 884 (1879); Zohary, Pal. Journ. Bot., Jer. Ser. 1: 252 (1939); Rech., Fl. Lowland Iraq 559 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 514 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 522 (1978).

Annual, small densely silky-hairy herb; stemless or stems short. Leaves lanceolate–



Glossonema edule N.E. Br.

PLATE 77



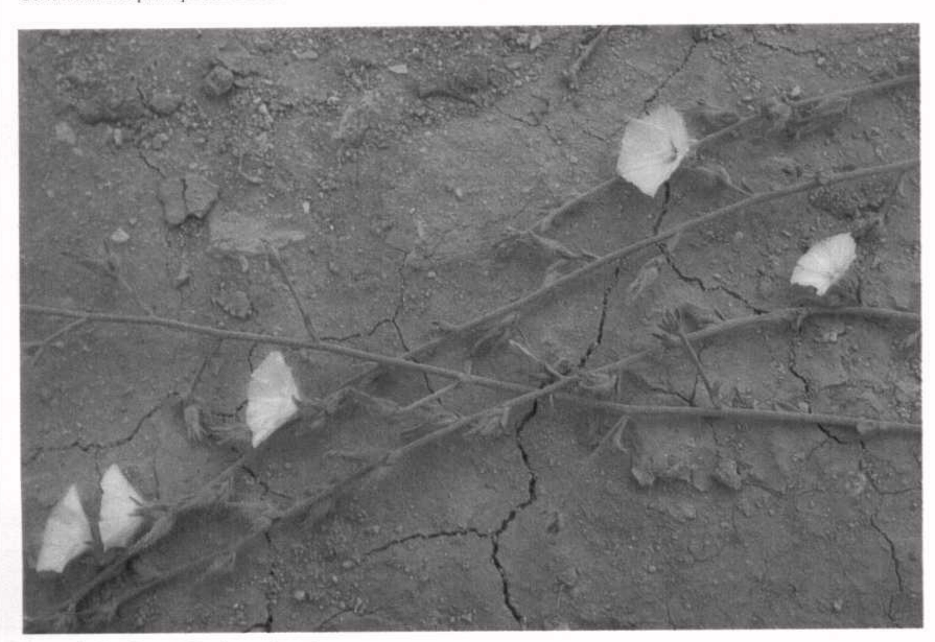
Leptadenia pyrotechnica (Forssk.) Decne.



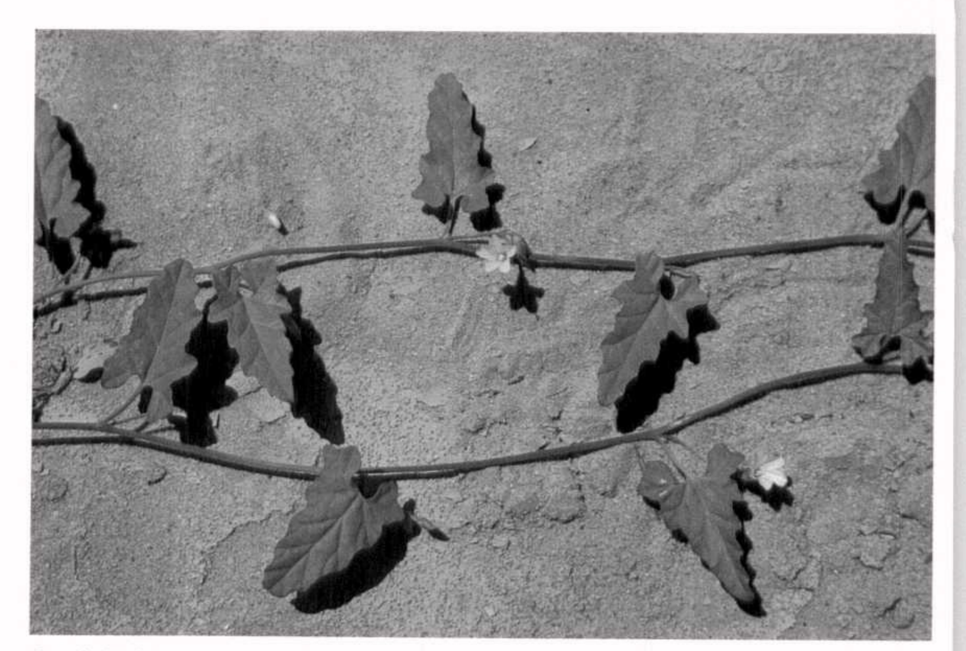
Leptadenia pyrotechnica (Forssk.) Decne.



Convolvulus cephalopodus Boiss.



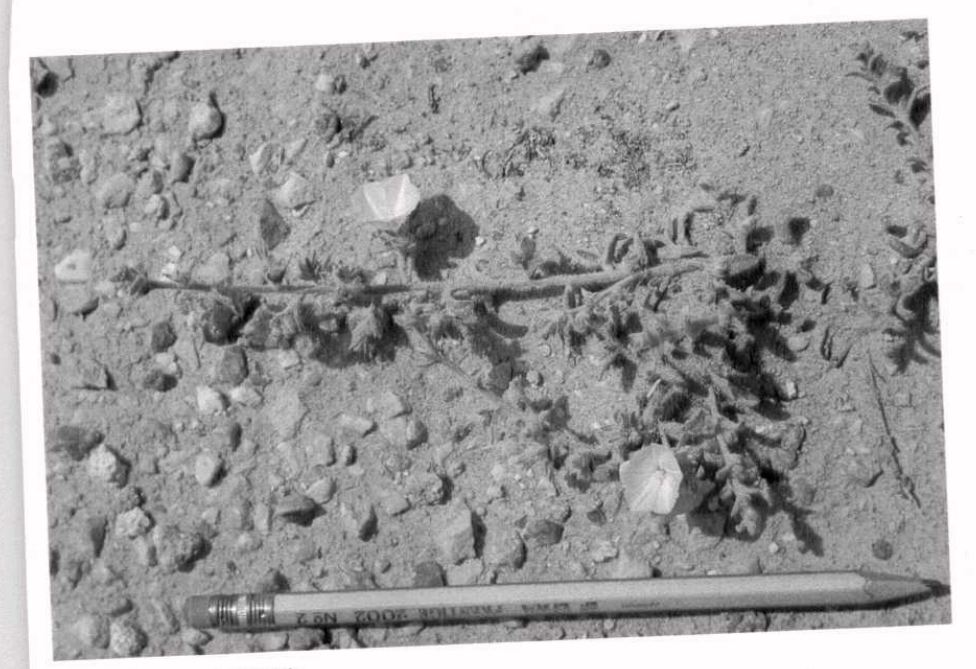
Convolvulus deserti Hochst et Steud.



Convolvulus fatmensis Ktze.



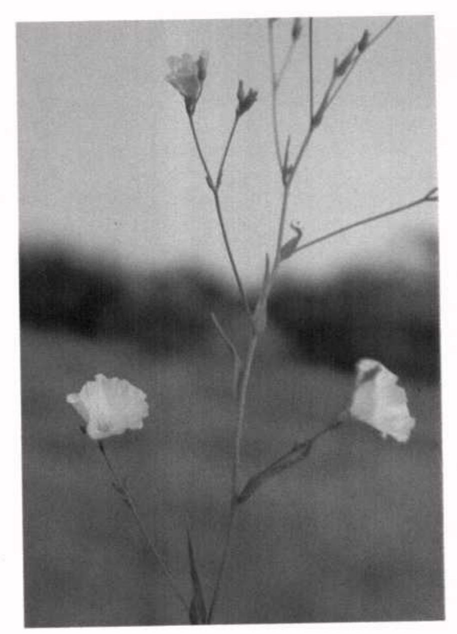
Concolvulus glomeratus Choisy.



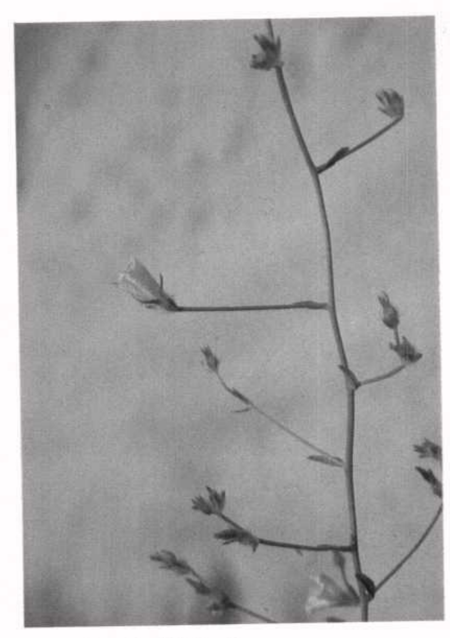
Convolvulus prostratus Forssk.



Convolvulus prostratus Forssk.



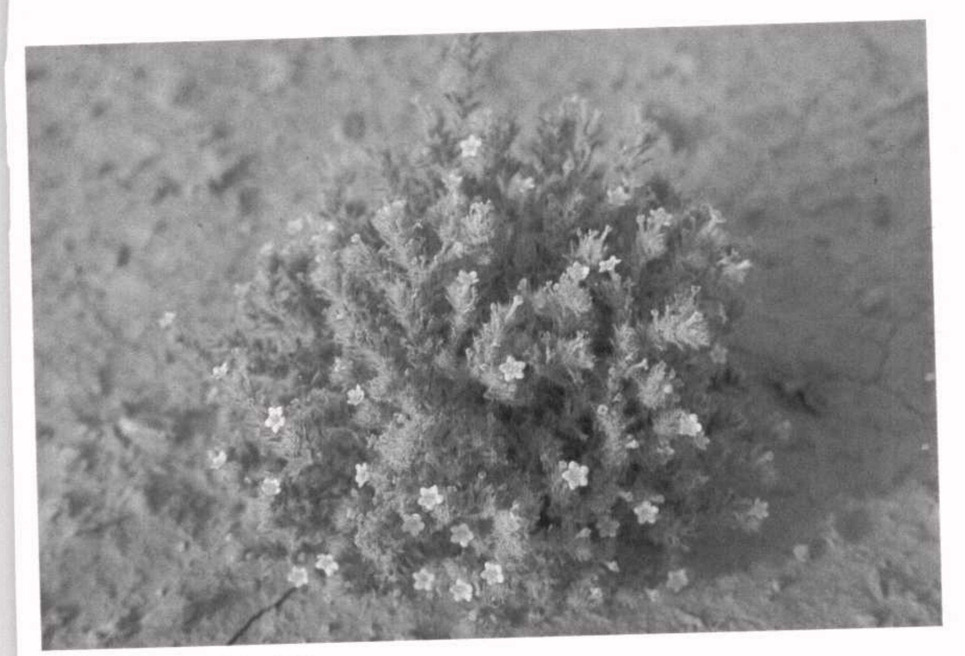
Convolvlus pilosellifolius Desr.



Convolvlus pilosellifolius Desr.



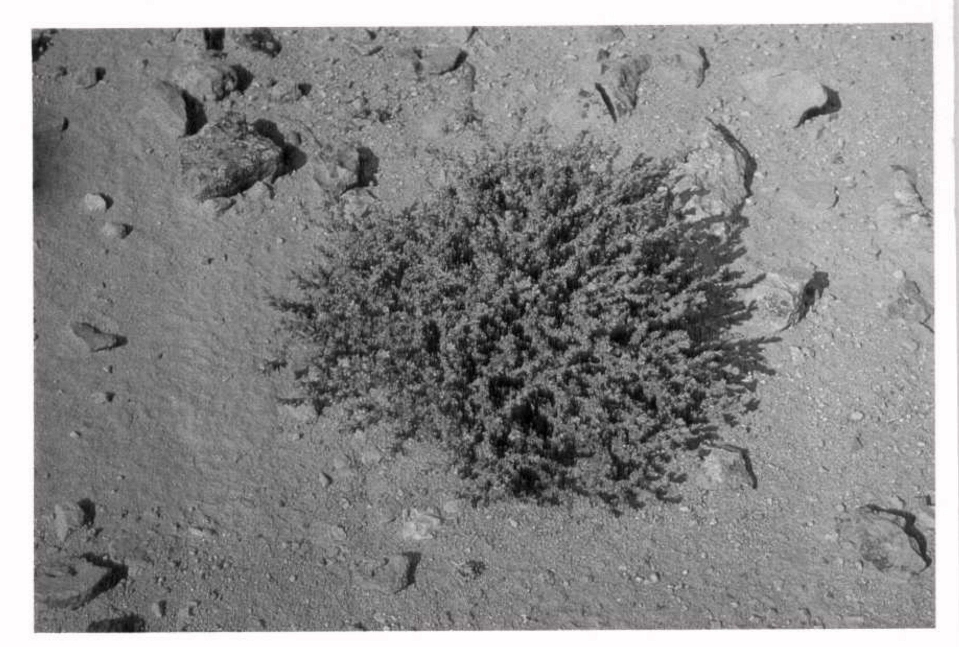
Cressa cretica L.



Arnebia hispidissima (Lehm.) DC.



Arnebia hispidissima (Lehm.) DC.



Echiochilon kotschyi Boiss.



Gastroctyle hispida (Forssk.) Bunge.

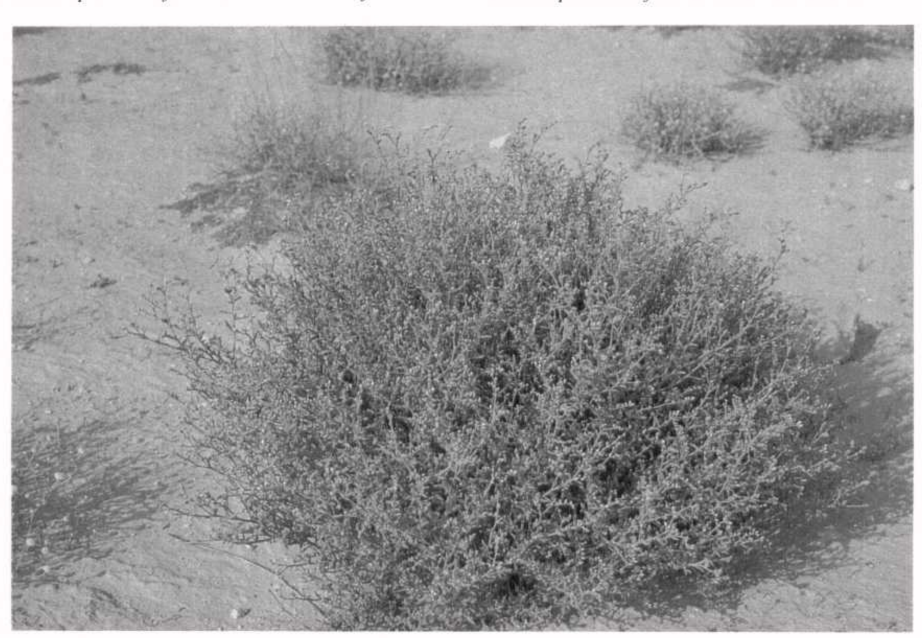
PLATE 84



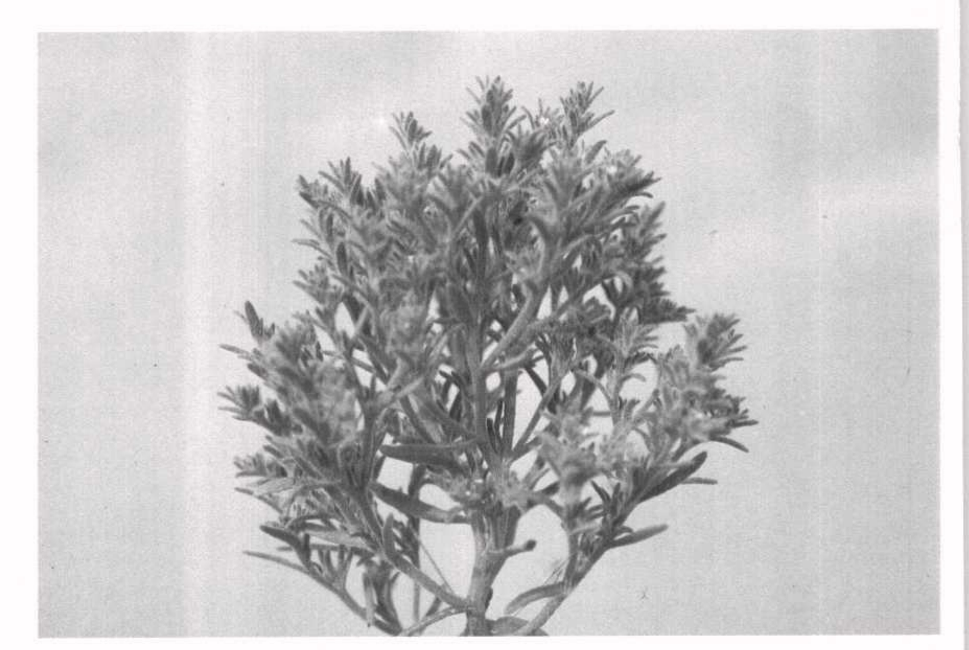
Heliotropium bacciferum Forssk. var. *bacciferum.*



Heliotropium bacciferum Forssk. var. *tuberculosum*



Heliotropium bacciferum Forssk. var. *bacciferum.*



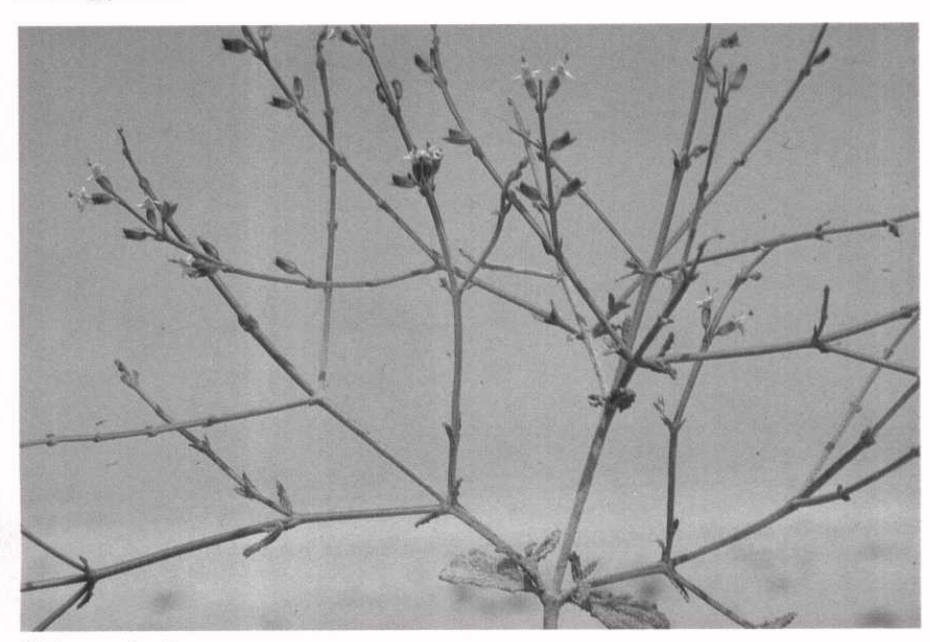
Lappula spinocarpos (Forssk.) Aschers.



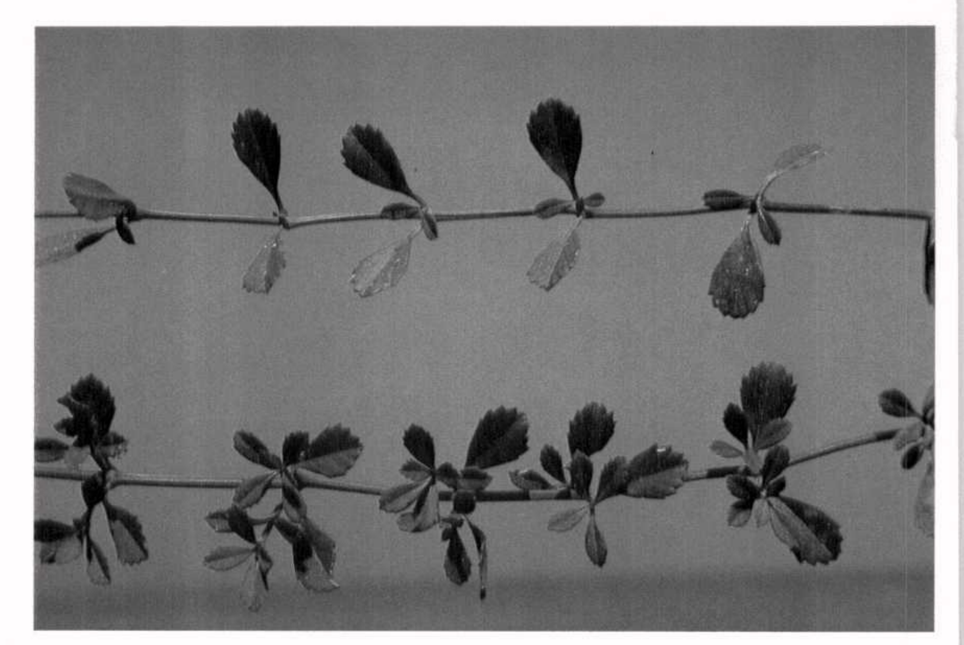
Moltkiopsis ciliata (Forssk.) Johnst.



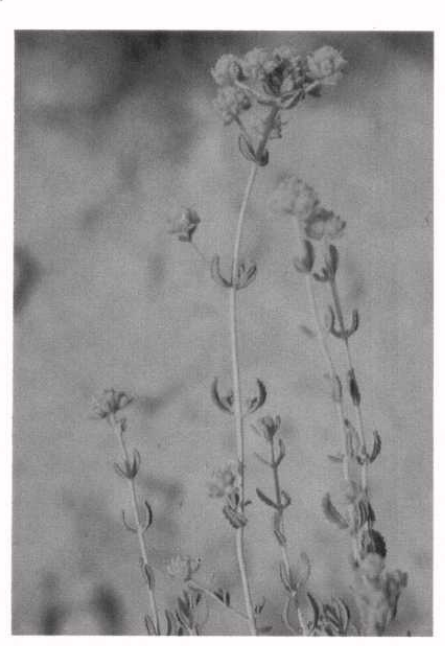
Salvia aegyptiaca L.



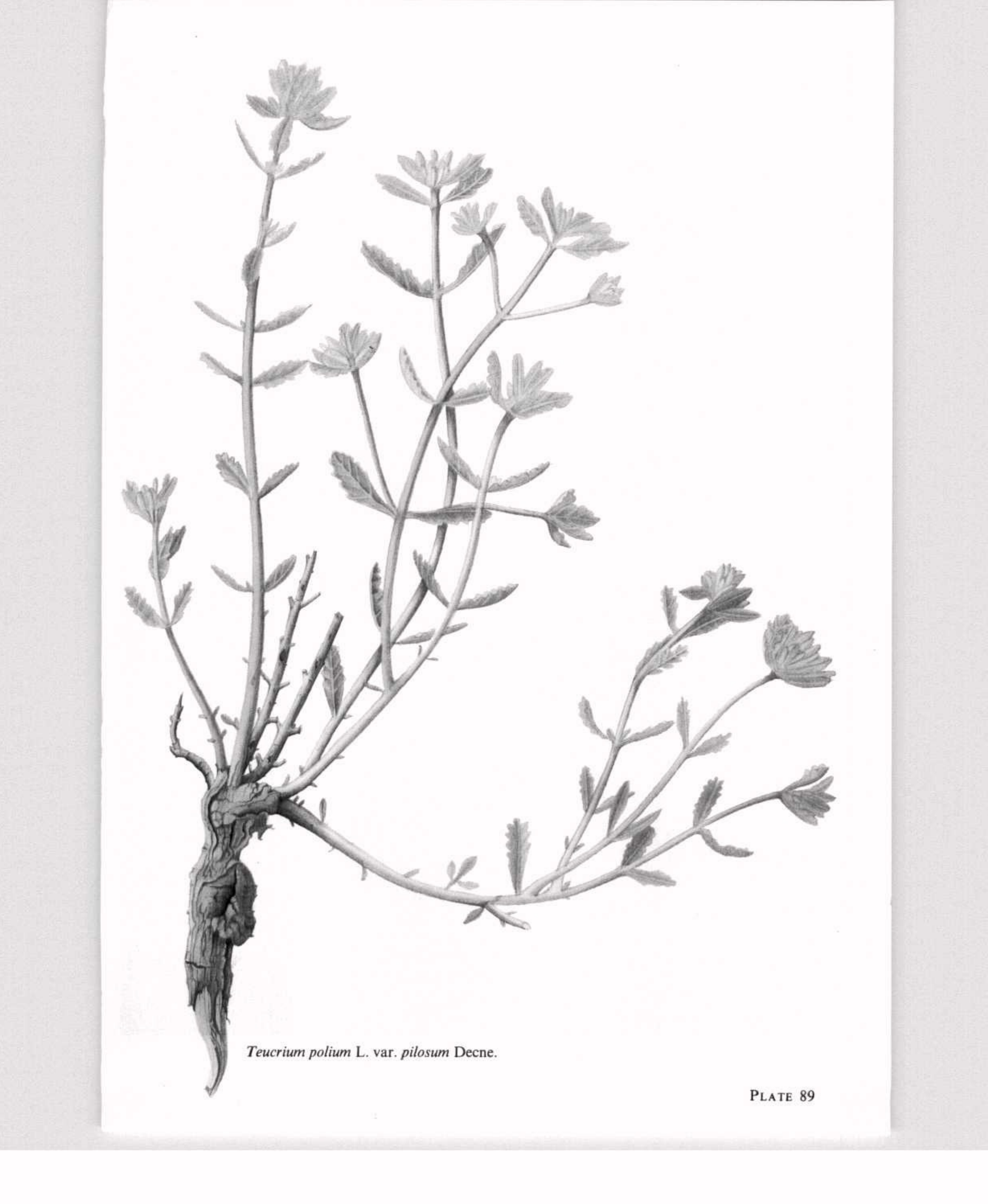
Salvia aegyptiaca L.



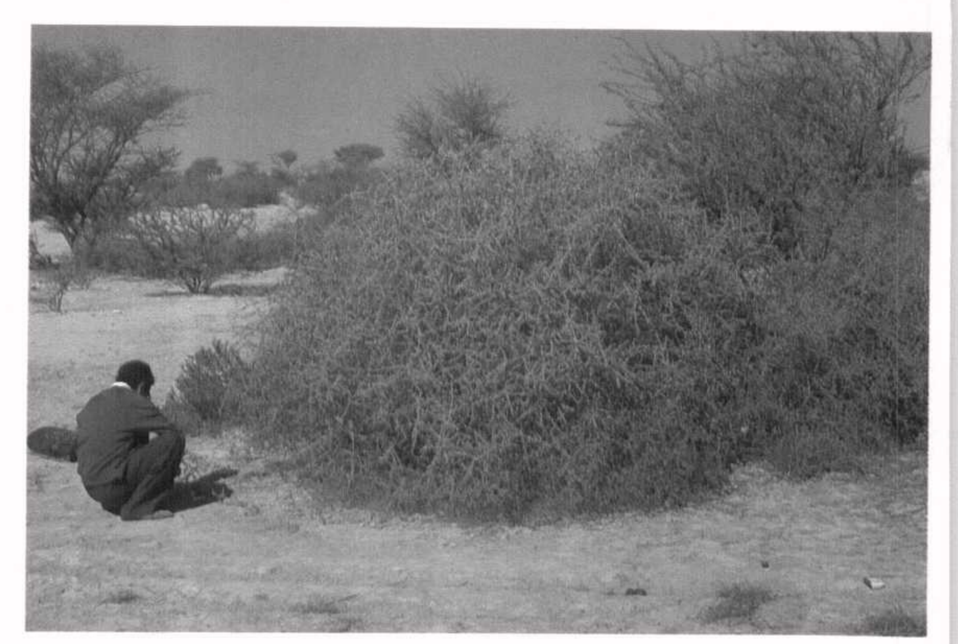
Lippia nodiflora (L.) Michx.



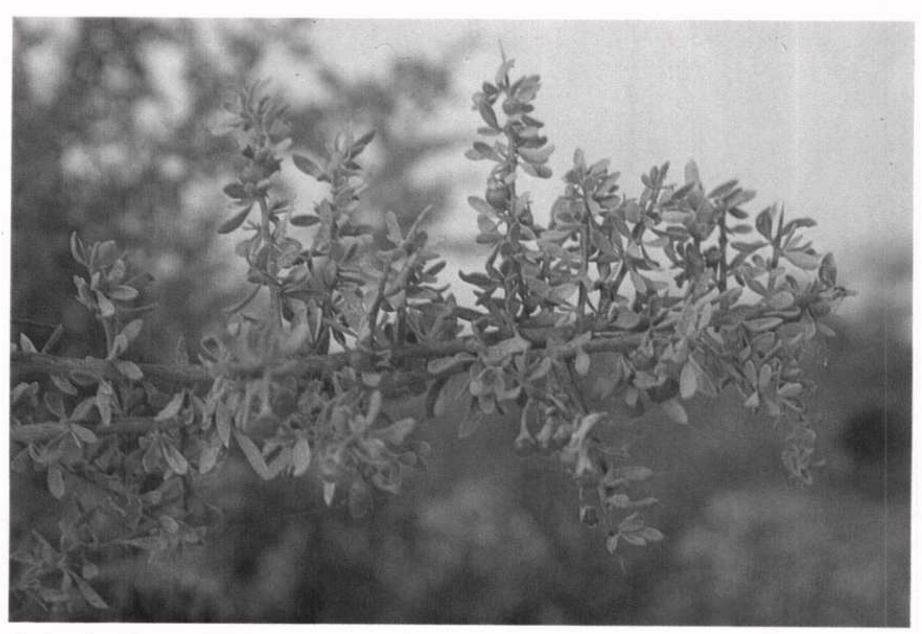
Teucrium polium L. var. *pilosum* Decne.



Teucrium polium L. var. *pilosum* Decne.



Lycium shawii Roem et Schult.

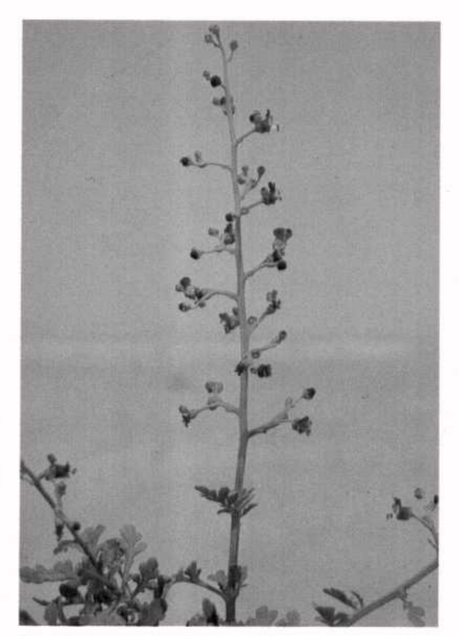


Lycium shawii Roem et Schult.

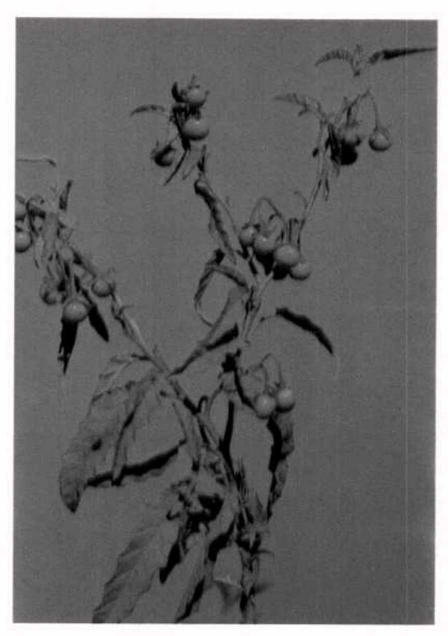
PLATE 90



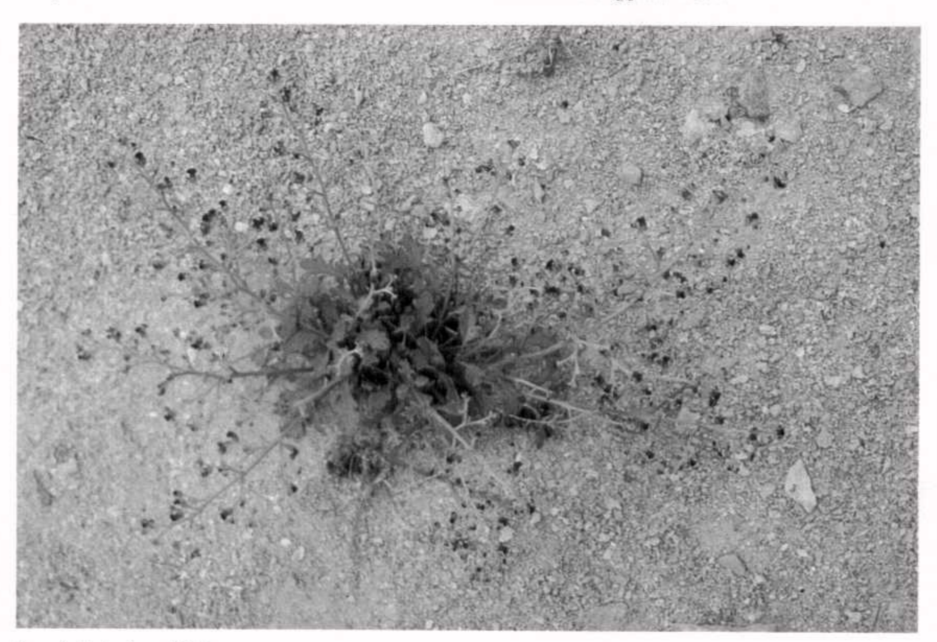
Lycium shawii Roem et Schult.



Scrophularia deserti Del.



Solanum elaengifolium Cav.



Scrophularia deserti Del.

PLATE 92

spathulate to obovate, acutish. Peduncles as long as leaves or shorter. Spikes ovate to oblong–cylindrical, densely villous. Bracts ovate, obtuse, equalling the calyx, hairy, herbaceous at midrib, widely scarious at margin and tip. Sepals obovate–spathulate to obovate, membranous, long villous at margin and apex. Tube of corolla glabrous, lobes laceolate, long villous outside. Capsule globose, 1·5 mm long.

Fairly common, especially in sandy habitats in southern Qatar. Flowering from February to April. Arabic name: *Quraitah* (Plate 94).

3. ***Plantago coronopus*** *L.*, Sp. Plant., ed. 1, 115 (1753); Boiss., Fl. Orient. 4: 888 (1879); Rech., Fl. Lowland Iraq 556 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 514 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 523 (1978).

Stemless adpresed-hairy, annual or biennial small herb. Leaves oblong–lanceolate to linear–lanceolate, pinnatifid with acute lobes forming a basal rosette. Scapes longer than leaves. Spikes cylindrical dense. Bracts adpressed-hairy, narrow-margined, ovate, acute or acuminate, usually shorter than calyx. Sepals rigid, ciliate, the posterior keeled-winged. Corolla tube hirsute, lobes ovate, acuminate, about 1 mm long. Capsule ovate, about 1·5 mm long.

Rare in Qatar; The plant grows on hard compact alluvial soil. Flowering from March to April. Arabic name: *Wideina*.

4. ***Plantago lanceolata*** *L.*, Sp. Plant., ed. 1, 113 (1753); Blatt., Journ. Ind. Bot. Soc. 11: 40 (1932); Rech., Fl. Lowland Iraq 556 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 514 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 523 (1978).

Perennial, stemless herbs. Leaves lanceolate, green, acute, tapering to a petiole, 3–5-nerved, glabrous or pilose. Scapes angled, much longer than leaves. Spikes ovate–oblong to cylindrical, 2–6 cm long. Bracts glabrous, ovate, acute or acuminate. The anterior sepals glabrous, usually united into 1, the posterior sepals usually hairy along keel. Corolla-lobes ovate, acuminate, about 2 mm long. Capsule oblong, 3–4 mm long.

Rare in Qatar. It occurs in cultivated areas. Flowering from June to November.

5. ***Plantago ovata*** *Forssk.*, Fl. Aegypt.-Arab. 31 (1775); Carter, Rec. Bot. Surv. India, 6, 6: 201 (1917); Zohary, Pal. Journ. Bot., Jer. Ser. 1, 3: 252 (1939); Rech., Fl. Lowland Iraq 558 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 516 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 522 (1978).

Small, annual, silky stemless herb. Leaves narrow linear to lanceolate. Scapes about as long as leaves or shorter. Spikes globular to ovate and oblong. Bracts orbicular, ovate, obtuse, glabrous. Sepals ovate, obtuse, scarious. Corolla lobes ovate–orbicular, acuminate, mucronulate, 2·5–3 mm long. Capsule broad ovate, 2·5–3 mm long.

Occasional in Qatar, particularly in sandy habitats. Flowering from February to April.

6. ***Plantage psyllium*** *L.*, Sp. Plant. 115 (1753); Rech., Fl. Lowland Iraq 560 (1964).

Annual, glandular pubescent. Stems erect, branched. Leaves opposite, linear. Peduncles from upper axils, about as long as leaves. Spikes ovate–spherical, glandular–

hairy. Bracts ovate–lanceolate, acute or acuminate. Sepals oblanceolate, acuminate. Corolla lobes ovate–lanceolate, acute, 2 mm long. Capsule broad–elliptic, 3–3·5 mm long.

Rare in Qatar. It has been found once on shallow alluvial soil along the road from Doha to northern Qatar near Umm Slal Mohammed. The collected specimens were flowering and fruiting in April.

49. *COMPOSITAE* GISEKE

Herbs or shrubs, sometimes with milky juice. Leaves alternate or opposite, without stipules. Flowers small, crowded into heads (capitula) on a common receptacle, surrounded by an involucre of 1 or more rows of free or variously connate bracts. Receptacle concave, convex or globose, rarely elongated, with or without bracts between the flowers. Flowers hermaphrodite or unisexual, the outer ones (ray-flowers) usually ligulate (i.e. strap-shaped), the inner ones (disc-flowers) usually tubular and actinomorphic. Calyx usually much modified, absent or reduced to bristles (pappus). Corolla gamopetalous, in the ray-flowers ligulate or thread-like, in the disc-flowers 4–5-lobed. Stamens 5, epipetalous, usually included in the corolla tube. Filaments free; anthers united. Ovary inferior, 1-locular, 1-ovuled. Fruit a sessile achene.

Key	Genus
O. Florets all, or at least the central ones, tubular (*Tubiflorae*).	
I. Heads of two kinds, male and female. Female heads 1- or 2-flowered, and later transformed into a spinescent fruit, enclosed in the hardened involucre	28. *Xanthium*
II. Heads all of the same kind.	
A. Leaves armed (thistles).	
1. Achenes silky	5. *Atractylis*
2. Achemes glabrous	7. *Carduncellus*
B. Leaves unarmed.	
1. Involucral scales spiny-tipped	8. *Centaurea*
2. Involucral scales spineless.	
a. Leaves opposite.	
x. Leaves with 3 parallel nerves beneath . . .	14. *Flaveria*
xx. Leaves not so	12. *Eclipta*
b. Leaves alternate.	
x. Pappus of hairs.	
•. Involucre scarious, translucent	16. *Ifloga*
••. Involucre not scarious, translucent . . .	
o. Woolly dwarf herbs	13. *Filago*
oo. Taller.	
– Flowers rose, white or very pale yellowish	11. *Conyza*
= Flowers bright yellow	
a. Pappus at base surrounded by a small scarious cup . . .	21. *Pulicaria*
b. Pappus without cup.	
+ Herbs	24. *Senecio*
+ + Shrubby, leaves crisped .	15. *Francoeuria*

xx. Pappus scarious or absent.
- •. Ray-flowers present.
  - o. Ray-flowers yellow.
    - – The outer involucre scales long, leaf-like, subtending the head . . 3. *Asteriscus*
    - = Not so.
      - a. Shrubby with white fleecy branches . . . . 23. *Rhanterium*
      - b. Not so.
        - + Leaves bipinnatisect . . 9. *Chrysanthemum*
        - + + Leaves undivided . . . 6. *Calendula*
  - oo. Ray-flowers bluish . . . . . . 4. *Aster*
- ••. Ray-flowers absent.
  - o. Shrubby plants . . . . 2. *Artemisia*
  - oo. Annuals.
    - – Glabrous herbs
      - a. Achenes of 2 kinds . . . . . 1. *Aaronsohnia*
      - b. Achenes nearly all alike.
        - + Achenes with a long wing; leaves only at the base. . . 26. *Tripleurospermum*
        - + + Achenes with short or no wing; leafy high up . . . . . 19. *Matricaria*
    - = Hairy plants with dichotomously branched, purple stems . . . . . 27. *Vicoa*

OO. Florets all ligulate, bisexual (*Liguliflorae*)
- II. Pappus of minute scales. . . . . 10. *Cichorium*
- II. Pappus of plumose hairs . . . . 20. *Picris*
- III. Pappus of soft, white, simple hairs.
  - A. Pappus stalked . . . . 17. *Lactuca*
  - B. Pappus sessile.
    - 1. Achenes all of the same kind, flattish . . . . . 25. *Sonchus*
    - 2. Achenes of 2 kinds in the same head . . . . .
      - a. Pappus deciduous, connate at base in a ring . . 22. *Reichardia*
      - b. Pappus persistent, if deciduous not ring-like at base 18. *Launaea*

1. *AARONSOHNIA* WARBG. ET EIG.

Herbs with alternate, pinnati- or bipinnatisect leaves, much branching from the base. Heads small, terminal, peduncled, many-flowered, discoid. Florets in many rows, hermaphrodite, fertile, tubular. Bracts in few rows, imbricated, broadly scarious-margined.

1. *Aaronsohnia factorovskyi* *Warbg. et Eig* Zion. Org. In St. Agric. Nat. Hist. 6: 39 (1927); Rech., Fl. Lowland Iraq 629 (1964).

Annual, 10–20 cm high, branching from the base. Stem and branches leafy; the branches terminating in a long, scape-like, 1-headed peduncle. Leaves pinnatisect, with linear segments. Head 6–7 mm in diameter, discoid. Achens of marginal florets slightly incurved, 15–20 ribbed at back, short-winged; achenes of disc-florets smaller, more incurved, with wing longer than they.

Occasional in Qatar in depressions. Flowering from February to April (Plate 95).

2. *ARTEMISIA* L.

Many-branched herbs or subshrubs, usually fragrant, with finely dissected leaves. Heads discoid, very small, sessile or short-peduncled in racemose panicles. Achenes cylindrical, or somewhat compressed not strongly ribbed. Pappus absent.

1. *Artemisia inculta* *Del.*, Fl. aegypt. Ill. 345, t. 43 (1813); Täckh., Stud. Fl. Egypt, ed. 2, 581 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 618 (1978).

A. herba-alba Asso., Fl. Arrag. 117, t. 8 (1779); Boiss., Fl. Orient. 3: 365 (1875); Rech., Fl. Lowland Iraq 631 (1964).

Suffrutescent, 20–50 cm high, woolly-canescent. Stems numerous, branching from the base. Root-leaves and leaves of sterile branches petioled, bipinnatipartite into oblong to oblong–linear lobes, those of flowering branches much smaller, few-lobed and clustered. Heads sessile, ovoid, brownish, erect. Involucre canescent; outer bracts very small, somewhat fleshy, orbicular, the inner ones oblong to oblong–linear, acute, with a very broad scarious margin.

Very rare in Qatar; recorded only along the road from Doha to northern Qatar in a small closed-in depression with shallow fine soil. Flowering specimens collected in May. Local name: *Shih.*

3. *ASTERISCUS* MILL.

Annual (ours) or perennial herbs or undershrubs, with alternate leaves and solitary heads terminating the lateral and terminal branches. Heads radiate. Ray-florets female; disc-florets bisexual, fertile, tubular. Outer involucral scales leaf-like, unarmed, supporting the hemispherical head. Receptacle chaffy. Pappus scarious, cup-like, dentate or divided.

1. *Asteriscus pygmaeus* *(DC.) Coss. et Dur.*, Sert. Tunet, 26 (1857); Boiss., Fl. Orient. 3: 179 (1875); Zohary, Pal. Journ. Bot., Jer. Ser. 1: 249 (1939) et Proc. Linn. Soc., Lond. 153, sess. 104 (1940–41); Rech., Fl. Lowland Iraq 61 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 77 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 565 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 568 (1978).

Odontospermum pygmaeum Benth. et Hook. (1873)

Low annual, stemless herb or with a few simple branches, indurate and persistent when dry till next year, covered with grey-villous hairs. Leaves oblong, obtuse, all tapering into a long petiole. Heads mostly solitary, large subtended by spathulate hairy entire leaves longer than the involucre. Ray-florets very short. Achenes silky; scales of pappus lanceolate–subulate, scarcely toothed.

Fairly common in Qatar, in depressions with fine-textured sediments—mainly in northern and central Qatar. Flowering from March to April (Plate 95).

4. *ASTER* L.

Herbs, usually erect. Leaves oblong–elliptic to linear–lanceolate. Heads usually radiate,

rarely discoid. Ray-florets in 1 row, female; disc-florets tubular, perfect, 5-toothed. Achenes flattened, beakless, with a pappus of many hairs in 1 or many rows.

1. *Aster squamatus* *(Spr.) Hieron ex Sod.*
Conyza squamata Spr., Syst. 3: 515.

Perennial, stiff, richly branched herb, with sessile, linear, entire, sharply acute leaves. Heads small, numerous. Involucre with imbricated, scarious-margined, small scales. Flowers bluish. Pappus with many long white bristles.

The plant is of American origin and is naturalized. It grows on waste land in farms. Flowering from March to May. The plant grows profusely in some *rodat* where irrigation water is spilled in marginal waste land, especially in northern Qatar (Plate 96).

5. *ATRACTYLIS* L.

Annual or perennial thistle herbs. Leaves lanceolate–linear or linear, ciliate-prickly or spiny. Heads supported with prickly leaves, many-flowered, discoid or radiate. Involucral scales not radiating. Fruit silky with plumose pappus.

1. *Atractylis carduus* (Forssk.) Christens., Dansk. Bot. Ark. 4 (3): 27 (1922); Täckh., Stud. Fl. Egypt, ed. 2, 534 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 565 (1978).
A. flava Desf., Fl. Atl. 2: 254 (1799); Rech., Fl. Lowland Iraq 640 (1964).

Annual or perennial, adpressed woolly, branching from the base. Leaves leathery, lanceolate–linear, sinuate-lobed, with short prickles. Heads terminal, solitary, 2–3 cm long, ovate. Leaves of the outer involucre about twice as long as the head. Inner involucral bracts woolly, broadly ovate to linear–lanceolate, abruptly prickly-tipped. Florets yellow, outer ones ligulate, radiating. Pappus twice as long as the achene.

Occasional in Qatar; in sandy habitats. Flowering from March to April (Plate 96).

6. *CALENDULA* L.

Annual herbs (ours) with oblong–lanceolate leaves, denticulate. Heads many-flowered, radiate. Ray-florets strap-shaped, female, fertile, yellow or orange. Disc-florets tubular, perfect, sterile, 5-cleft. Achenes of different forms. Pappus absent.

1. Plants up to 25 cm high; fruiting heads devoid of broadly 3-winged achenes, dorsally spineless outer achenes . . . . 1. *C. arvensis*
2. Plants up to 10 cm high; fruiting heads with at least a few broadly 3-winged achenes, dorsally spineless outer achenes . . . . . 2. *C. tripterocarpa*

Calendula arvensis *L.*, Sp. Plant., ed. 2, 1303 (1762–63); Boiss., Fl. Orient. 3: 418 (1875); Carter, Rec. Bot. Surv. Ind. 6 (6): 204 (1917); Täckh., Stud. Fl. Egypt, ed. 2, 583 (1974); Heyn *et al.*, Israel Journ. Bot., 23: 180 (1974).

Annual, much-branched herb, pilose or glandular-pubescent. Stems ascending or decumbent. Lower leaves broad, oblong to narrowly obovate, margin repand–dentate to subentire. Heads 1·2 cm across. Ray-florets yellow to orange, less than twice as long as bracts; disc-florets either concolours with ray-florets or violet-purple. Fruiting heads usually with 3–4 different achene types: wingless achenes with narrow incurved or

expanded beak; cymbiform achenes with wide to narrow opening; beaked or more often beakless, broadly winged achenes with laciniate margins; annulate achenes, dorsally from rugose to spiny.

This species is highly polymorphic with many segregates (*af.* Heyne *et al.*, 1974).

Common in Qatar in depressions with fine soil. Flowering from February to April. Arabic name: *Hanwa*, a name used in other countries in the Arabian peninsula, also for other *Calendula* species (Plate 97).

2. *Calendula tripterocarpa* *Rupr.*, Bull. Phys-Math. Acad. St. Petersb. 14: 231 (1856); Heyn *et al.*, Israel Journ Bot 23: 178 (1974).

C. aegyptiaca Desf. (—*forma carpica 'alata erostris'* ssp. *tripterocarpa* (Rupr.) Lanza, Monogr. Calendula 110, t. 4 (1919)).

Usually small, much-branched spreading annuals, glandular–pubescent, sometimes also pilose. Lower leaves linear–oblong, acute; margin repand–dentate, rarely entire. Head 0·5–1·5 cm across, concolorous, yellow to orange. Ray-florets slightly exceeding the bracts. Fruiting heads with at least a few beakless tripteroid achenes not spiny on their dorsal side, wings broad, entire, to slightly toothed; cymbiform and annulate achenes present, rostrate achenes absent.

Rare in Qatar on sandy and gravelly soil. Flowering from February to April.

7. *CARDUNCELLUS ADENS.*

Perennial thistles. Leaves spiny-serrate or spiny-pinnatifid. Heads solitary subtended by complete spiny-pinnatifid leaves. Flowers white or pale yellow. Inner involucral scales fringed at tip. Achene glabrous. Pappus of plumose or simple stiff bristles.

1. *Carduncellus eriocephalus* *Boiss.*, Diagn. Ser. 1, 10: 100 (1849); Post, Fl. Syr., Pal. et Sinai 2: 122 (1933); Täckh., Stud. Fl. Egypt, ed. 2, 546, t. 191 (1974).

A perennial thistle plant with simple stem, rarely few-branched, terminated by a large, densely hairy head, surrounded by spiny leaves. Flowers pale yellow. Pappus of simple stiff hairs.

Occasional in southern Qatar; in sandy habitats. Flowering from March to May.

8. *CENTAUREA L.*

Perennial, biennial, or annual (ours) herbs, erect or prostrate, usually rigid, with alternate leaves, entire or pinnatifid, rarely prickly. Florets all tubular. Involucral scales in several rows, imbricated, leathery or membranous, usually with an appendage which is laciniate, ciliate, toothed, pectinate or spiny. Pappus peristent of 2 kinds, an outer one of several rows of bristles or scales of which the inner ones longer; an inner one of a crown of short, connate scales. Receptacle hairy.

1. *Centaurea sinaica* *DC.*, Prodr. 6: 592 (1837); Boiss., Fl. Orient. 3: 687 (1875); Zohary, Pal. Journ. Bot., Jer. Ser. 1 (3): 251 (1939); Rech., Fl. Lowland Iraq 657 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 541 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 566 (1978).

Annual cobwebby herb, branching from the base, the branches dichotomous,

proliferous. Stems and branches winged, the wings narrow, shorter than the internodes. Root-leaves narrow oblong, pinnatifid, intermediate and upper stem-leaves smaller and less dissected. Heads in forks or terminal, short-peduncled, solitary, ovoid, somewhat bracted by the upper leaves. Involucral scales sparsely cobwebby, the outer and intermediate ones ending in long spines, overtopping the flowers, with 2–3 rather remote prickles on each side, often reddish-flushed. Flowers flesh coloured or white. Achenes shining brown. Pappus of an outer row of simple hairs and in the middle a short crown of scales.

Occasional in Qatar. Flowering from March to April (Plates 97, 101).

9. *CHRYSANTHEMUM* L.

Glabrous annual herbs with broadly bipinnatisect leaves and large heds with scarious involucre and white or yellow ray-florets. Receptacle naked, pappus crown-like or absent.

1. *Chrysanthemum coronarium* *L.*, Sp. Plant., ed. 1, 1254 (1753); Post, Fl. Syr., Pal. et Sinai, 2: 61 (1933); Täckh., Stud. Fl. Egypt, ed. 2, 579 (1974).

Annual herbs with glabrous bipinnatisect leaves. Heads large, solitary, terminal, with bright yellow flowers. Involucre scarious. Receptacle naked.

Rare in Qatar, it grows only in lawns at Doha where continuous irrigation is practiced. Flowering from March to April.

10. *CICHORIUM* L.

Annual (ours) or perennial herbs, glabrous or sparingly hispid, with milky sap. Leaves alternate, sessile. Heads with blue, ligulate florets. Receptacle flat, naked. Achenes 5-angled or the outer ones rather compressed. Pappus of minute scales or absent.

1. *Cichorium pumilum* *Jacq.*, Obs. Bot. 4: 3, t. 80 (1771); Rech., Fl. Lowland Iraq 663 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 585, t. 209 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 445 (1978).

Annual herb. Root leaves dentate or runcinate–pinnatipartite from the base, stem leaves minute, linear. Lateral heads sessile, in clusters of 2 or several, the terminal heads solitary, peduncled; peduncles thickened at length and club-shaped. Involucral scales slightly hairy but not glandular. Flowers 3 times as long as the involucre. Pales of pappus oblong, one-quarter the length of the achene.

Rare in Qatar; it grows as a weed in alfalfa fields. It has been recorded at Al-Wabrah. Flowering in the summer.

11. *CONYZA* LESS.

Herbs or shrubs with alternate, entire or toothed or divided leaves. Flower heads solitary or corymbose. Flowers usually white, purple or pale yellow. Central flowers bisexual, few. The numerous others male with filiform corollas. Ligules absent or inconspicuous and scarcely if at all exceeding the pappus. Pappus of numerous, hair-like bristles.

I. Herbs; leaves linear; heads in a rich panicle . . 1. *C. bonariensis*
II. Shrubs, leaves ovate–oblong; heads corymbose . 2. *C. dioscorides*

1. *Conyza bonariensis* (*L.*) *Cronquist*., Bull. Torrey Bot. Club 70: 632 (1943); Davis, Fl. Turkey 5: 133 (1975).

Erigeron crispus Pourr., Mém. Acad. Toulouse 3: 318 (1788).

E. bonariensis L., Sp. Plant. 863 (1753); Rech., Fl. Lowland Iraq 596 (1964).

E. linifolius Willd., Sp. Plant. 3: 1955 (1803).

Conyza linifolia (Wild.) Täckh., Stud. Fl. Egypt, ed. 2, 549 (1974); Migahid. Fl. Saudi Arab., ed. 2, 1: 619 (1978).

Annual. Stem erect or ascendent, up to 100 cm high, densely pubescent. Leaves numerous, linear, entire or with narrow acute lobes, lower leaves alternate into a petiole, the upper ones sessile, acuminate. Heads in a rich panicle. Scales densely covered with short grey hairs, shorter than the pappus. Female florets in several rows, whitish or pinkish.

Occasional weed in waste places beside gardens and along irrigation canals in cultivated *rodat*. Flowering from April to May (Plate 97).

2. *Conyza dioscorides* (*L.*) *Desf.* Tab. ed. 2, 114 (1815); Boiss., Fl. Orient. 5: 217 (1875); Rech., Fl. Lowland Iraq 596 (1964); Täckh., Stud. Fl Egypt, ed. 2, 549, t. 193 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 619 (1978).

Pluchea dioscorides (L.) DC., Prodr. 5: 450 (1856).

Shrub, 1–3 m high, richly branched, glandular–puberulent. Leaves ovate–oblong, acutish, serrate. Heads numerous, corymbose, terminating the leafy branches. Branches of corymb with a few small, linear leaves. Flowers pale yellow or pink. Achenes glabrous, much shorter than the pappus consisting of a few bristles.

Rare in Qatar; recorded only once at Doha. It is interesting to know that the only individual recorded grows in one of the busy streets of Doha city, Al-Kaharba Street, in front of the shop of a hairdresser where water is spilled continuously. The collected material was flowering in May.

12. *ECLIPTA* L.

Annual herbs, with opposite, entire or toothed leaves. Heads many-flowered, radiate, terminal or axillary, pedunculate. Receptacle with a few narow scales. Achenes unarmed, pappus absent.

1. *Eclipta alba* (*L.*) *Hausskn.*, Pl. Jov. Rar. 528 (1848); Bois., Fl. Orient. 3: 249 (1875); Rech., Fl. Lowland Iraq 612 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 568, t. 203 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 621 (1978).

E. erecta L., Mantiss. 2: 286 (1771); Blatt., Journ Ind. Bot. Soc. 11: 38 (1932).

Annual, erect herb, richly branched from the base; branches opposite. Leaves oblong–lanceolate, tapering at both ends, densely adpressed rough hairy. Heads peduncled from the leaf-axils, single or in pairs. Involucral bracts scarcely longer than the florets, hairy at apex.

Rare in Qatar; recorded along an irrigation canal in irrigated *rodah* in northern Qatar. Flowering mainly in the summer.

13. *FILAGO L.*

Annual herbs, erect or procumbent, cottony-tomentose or adpressed canescent. Leaves alternate, entire. Heads minute, sessile, globose, terminal and axillary clusters, surrounded by leaves, short or overtopping them. Marginal florets female, disc-florets hermaphrodite. Involucral scales similar to the chaff of the receptacle. Pappus of scabrous, hair-like bristles, equalling the florets.

Filago from *filum*, a thread, due to the cottony hairs on the plant. The local Arabic name is *Qottainah*, from the Arabic *Qotn* denoting cotton.

1. *Filago spathulata* *Presl.* (incl. *F. prostrata* (Parl.)) Boiss., Fl. Orient. 3: 246 (1875); Rech., Fl. Lowland Iraq 600 (1964).

Annual, dwarf herb, densely adpressed canescent. Stem prostrate or ascending, forked or corymbose above. Leaves oblong–spathulate, obtuse, all tapering towards base. Heads 8–17 in dense, spherical clusters, sessile in the forks and terminal, surrounded by spreading leaves usually overtopping them. Florets small, yellow. Pappus present.

Occasional in Qatar in depressions and sandy habitats. Flowering from March to April. Local name: *Quttainah* (Plate 98).

14. *FLAVERIA A. JUSS.*

Annual herbs with opposite, sessile, lanceolate leaves. Heads small, yellow, clustered. Disc corollas tubular, 5-toothed. Involucre of 2–5, keeled, concave bracts. Achenes naked, unarmed, without pappus.

1. *Flaveria trinervia* *(Spreng.) Mohr.*, Contr. U.S. Nat. Herb. 6: 180 (1901); Täckh., Stud. Fl. Egypt, ed. 2, 572 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 651, t. 645 (1978).

Erect or diffuse dichotomously branched, glabrous or slightly puberulent, annual herb. Leaves lanceolate, narrow with 3 parallel nerves beneath. Heads narrow, few-flowered, densely clustered, axillary or terminal, along the top of the branches. Achene naked.

Occasional weed in cultivated moist land. Flowering in the late summer and autumn. Adv. from Tropical America.

15. *FRANCOEURIA CASS.*

Suffrutescent plants, adpressed–canescent with linear spathulate, half-clasping leaves, and corymbosely panicled, with yellow-flowering heads. Marginal florets female, lingulate, in 1 row. Disc-florets bisexual, tubular, 5-toothed. Involucre inbricated, in several rows. Receptacle naked. Achenes beakless. Pappus in 2 rows, the outer very short, cup-like, toothed, the inner composed of brittle thickened bristles, both united and both together caducous. A genus close to *Pulicaria*.

1. *Francoeuria crispa* *(Forssk.) Cass.*, Dict. Sc. Nat. 38: 374 (1825); Rech., Fl. Lowland Iraq 609 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 563 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 595 (1978).

Pulicaria crispa (Forssk.) Benth. et Hook. F., Gen. Pl. 2: 336 (1867).

Perennial bushy desert plant, often growing in cushion-shape, much branching from the base. Stems numerous, adpressed–canescent or whitish, divaricately corymbose above. Leaves of various appearance, on juvenile shoots long and white woolly, on adult branches minute, green, half-clasping, narrowly linear–spathulate, acutely toothed or undulate. Peduncles terminal with scale-like leaves or bracts. Heads 5 mm broad, yellow, appearing discoid because of its very short ray-florets, usually not longer than the disc. Inner pappus of 7–10 bristles, 4 times as long as the achene, bearded at the tip.

Very common plant in Qatar. It grows mainly in the habitats locally known as *Mangaa'* where water accumulates after rainfall and the soil is fine-textured. The plant is used in folk medicine for various purposes. Flowering almost all the year round. Local name: *Githgath* or *Yithyath* (Plates 98, 99, 103).

16. *IFLOGA CASS.*

Small annual herbs forming a dense cylindrical leafy spike of small head clusters. Leaves narrow, linear, almost thread-like, protruding from the spikes. Heads many-flowered discoid. Involucre scarious. Receptacle elongated, naked at centre. Achenes of pistillate florets bald, of perfect ones with 1 row of feathery-tipped pappus.

1. *Ifloga spicata* *(Forssk.) Sch. Bip.* in Webb. et Berth., Phyt. Canar. 2: 310 (1845); Boiss., Fl. Orient 3: 248 (1875); Carter, Rec. Bot. Surv. Ind. 6 (6): 202 (1917); Zohary, Pal. Journ. Bot., Jer. Ser., 1 (3): 250 (1939) et Proc. Linn. Soc. Lond., 153, sess. 104 (1940–41); Rech., Fl. Lowland Iraq 599 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 552 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 593 (1978).

I. fontanesii Cass., Dict. Sc. Nat. 23: 14.

Annual, 5–10 cm high, branching from the very base into several simple stems. Each branch forms leafy, cylindrical spikes. Leaves linear–subulate, 1–1·5 cm long, protruding from the spike. Flowers 2–3 in a cluster, arranged in dense, many-flowered, leafy spikes. Involucre scarious, tapering into a long point. Bristles of pappus denticulate at base. It is a multiform species.

Common plant in Qatar. It grows on sandy soil. Grazing animals feed on it. Flowering from February to April. Local name: *Hasach* or *Hasaj.*

17. *LACTUCA L.*

Annual, biennial or perennial herbs, with milky juice. Heads 5- or many-flowered, narrow, cylindrical. Florets all ligulate, fertile, yellow, pale red or blue. Involucre imbricated or 2-rowed. Achenes all alike, compressed, beaked. Pappus stalked, of soft, white, simple hairs.

1. *Lactuca saligna* *L.*, Sp. Plant., 796 (1753); Rech., Fl. Lowland Iraq 680 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 610 (1974); Magahid, Fl. Saudi Arab., ed. 2, 1: 542 (1978).

Tall annual or biennial herb, up to 1 m. Stem erect, rigid, whitish, simple or several from the base, not green-striped, terminating into virgate elongate branches forming a narrow, strict panicle. Leaves prickly or unarmed, narrow. Stem leaves usually entire, sagittate at the base. Heads on short pedicels, more than 5-flowered, about 1 cm long. Flowers yellow

or drying violet blue. Achenes ovate–oblong, 5–7 striate on each side. Beak white, twice as long as the achene.

Rare in Qatar; recorded only once in the government farm, northern Qatar in a moist habitat.

18. *LAUNAEA CASS.*

Suffrutescent, perennial or annual herbs, with rosetted leaves. Heads many-flowered. Florets all ligulate, fertile. Involucre imbricate, frequently with white-margined scales. receptacle flat, naked. Achenes narrow, not compressed, truncate at apex. Pappus copiously setose, fine, white, smooth, deciduous in one piece.

I. Heads densely clustered towards the apex of an almost naked stem. Achenes broad, yellow, winged . . . . 1. *L. capitata*
II. Heads not clustered. Achenes narrow, cylindrical.
  1. Involucral scales narrowly linear, all achenes glabrous.
    a. Achines 5–6-furrowed, obtuse at tip and obtusely ribbed. Pappus persistent . . . . 4. *L. nudicaulis*
    b. Achenes 4-angled, the outer black, acutish at tip. Pappus very caducous . . . . 5. *L. procumbens*
  2. Involucral scales broad, some of the achenes hairy.
    a. Pappus deciduous, as long as achene . . . . 2. *L. cassiniana*
    b. Pappus persistent, heteromorphous, partly of a tuft of hairs, partly of 12–13 bristles much protruding above the hair pappus . . . . 3. *L. mucronata*

1. *Launaea capitata* *(Spreng.) Dandy*, in Andrews, Flow. Plants Sudan 3: 40 (1956); Rech., Fl. Lowland Iraq 677 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 78 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 602 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 543 (1978).

L. glomerata (Cass.) Hook. f., Fl. Brit. Ind. 3: 417 (1881).

Biennial herb, 5–15 cm high, glabrous. Stem scape-like, nearly leafless, simple or 2-forked. Root-leaves rosetted, tapering at base, runcinate–pinnatifid into numerous, triangular–ovate toothed lobes. Heads nearly sessile, the terminal head clustered, the lateral heads usually solitary, oblong–cylindrical. Involucral bracts with broad, white margins. Achenes short, white, 4-winged at the lateral edges as well as at the middle ridge, wings often as broad as the achene. Pappus white, caducous.

Very common in various habitats. Flowering from February to May. Local name: *Howwah* (Plate 100).

2. *Launaea cassiniana* *(Jaub. et Spach.) Burkill*, Pl. Baluchist. 44 (1909); Täckh., Stud. Fl. Egypt, ed. 2, 602 (1974); Magahid, Fl. Saudi Arab., ed. 2, 1: 544 (1978).

Zollikoferia cassiniana (Jaub. et Spach), Boiss., Fl. Orient. 3: 822 (1875).

A stout richly branched, annual or biennial herb. Leaves deeply cut with narrow lobes. Heads not clustered, 5 mm broad or more. Involucral scales broad, not white-margined. Achenes short, narrow cylindrical, beakless and wingless. Pappus short, as long as achene, deciduous.

Occasional in Qatar in sandy habitats, particularly in central and southern Qatar. Flowering from March to April. Local name: *Bagraa* (Plate 101).

3. *Launaea mucronata* *(Forssk.) Muschler*, Man. Fl. Egypt, 2: 1057 (1912); Rech., Fl. Lowland Iraq 675 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 602 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 543 (1978).

Zollikoferia mucronata Boiss., Diagn. Pl. Or. Nov. Ser. 1, 7: 12 (1846).

Perennial, glabrous herbs, with erect, dichotomously branched and losely corymbose stems. Lower leaves petioled, lanceolate in outline, bipinnatipartite or lobed, lobes oblong to linear, mucronate. Stem leaves oblong, auricled-toothed or many-clefted at the base. Heads terminal, ovate, on rather long peduncles. Involucral scales white-margined, ovate to oblong, tip of the outer ones contracted into an obtuse prickle. Achenes with persistent pappus longer than the achenes. Resembling *L. cassiniana* but always recognized by its persistent heteromorphous pappus, longer than the short achene.

Occasional in sandy habitats in southern Qatar. Flowering from March to April.

4. *Launaea nudicaulis* *(L.) Hook.* f., Fl. Brit. Ind. 3: 416 (1881); Carter, Rec. Bot. Surv. Ind., 6 (6): 205 (1979); Zohary, Pal. Journ. Bot., Jer. Ser. 1: 251 (1939) et Proc. Linn. Soc., Lond. 153, sess. 105 (1940–41); Rech., Fl. Lowland Iraq 676 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 602 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 544 (1978).

Perennial herb with erect or decumbent, dichotomously and diverticately branching stems. Root leaves rosetted, deeply lobed into triangular lobes which are cartilagenous-toothed. Heads lateral and terminal, cylindrical, few-flowered, on very short peduncles. Involucral bracts herbaceous, with broad white margins, the outer ones triangular, the inner ones oblong–linear. Achenes columnar-prismatic, 5–6-furrowed, obtuse at tip, the outer ones wrinkled-muricate. Pappus persistent, white, bristles longer than the achene.

Very common in various habitats in Qatar. Flowering from February to April, also in diferent seasons. Local name: *Howwah* (Plate 102).

5. *Launaea procumbens* *(Roxb.) Ramayya et Rajagopal*, Kew Bull. 23: 465 (1969); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 78 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 602 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 544 (1978).

Zollikoferia fallax (Jaub. et Spach) Boiss., Fl. Orient. 3: 824 (1875). *Launaea fallax* (Jaub. et Spach) O. Kuntze.; Rech., Fl. Lowland Iraq 676 (1964).

Perennial herb with nearly leafless, ascendent or decumbent stems. Root-leaves rosetted, broad linear in outline, runcinate–pinnatipartite into cartilagenous toothed triangular or oblong lobes. Stem leaves very few, minute, at the lower forks only. Heads lateral and terminal, cylindrical, few-flowered, on very short peduncles. Involucral bracts with broad white margins. Achenes columnar-prismatic, nearly 4-angled, the outer ones black, scabrid, rugose, acutish at tip, the inner ones white, smooth, truncate at apex. Pappus very caducous.

Very common plant in Qatar; in cultivated land, coastal sandy habitats near Abu Samrah and in *rodat* with considerable water resources. Flowering mainly in the spring, also in different seasons. Local name: *Howwah* (Plate 100).

19. *MATRICARIA L.*

Glabrous annual herbs, with capillary dissected leaves. Heads more or less conical with naked receptacle. Involucral scales scarious, imbricated. Achenes terete, inner face 3–5-ribbed. Pappus crown-like or absent.

1. *Matricaria aurea* *(Loefl.) Sch.-Bip.*, Bonplandia 8: 369 (1860); Post, Fl. Syr., Pal. et Sinai 2: 58 (1933); Rech., Fl. Lowland Iraq 627 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 578 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 620 (1978).

Annual, glabrous, about 15 cm high. Stems often several, ascending or erect, branching from the base, many-headed. Leaves bipinnatisect. Heads about 4–5 mm in diameter, discoid, on long peduncles, axillary in the upper leaves and terminal. Involucral scales glabrous, the inner ones broadly scarious margined. Achenes very small, subterete, bald or short-auricled, 3-ribbed ventrally.

Rare in Qatar, on fine-textured soil. Flowering from March to April.

20. *PICRIS L.*

Hispid annual (ours) or perennial herbs, with a basal rosette of leaves, and numerous or few stem-leaves. Heads many-flowered. Florets all ligulate, yellow. Involucral scales all narrow, of equal length or with a few smaller ones at the base. Achene tapering or beaked. Pappus consisting of whitish bristles, of which the inner ones at least are plumose.

1. *Picris radicata* *(Forssk.) Less.*, Syn. 134 (1832); Täckh., Stud. Fl. Egypt, ed. 2, 597 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 542 (1978).

A small annual hairy herb. Root-leaves densely rosetted oblanceolate, deeply pinnatifid to almost pinnatisect with narrow, often rounded lobes. Stem leaves few, linear. Peduncles long, scarcely thickened, heads 1·5 cm long. Marginal achenes cylindrical, incurved, truncate, inner ones very small, oblong, rounded or narrowed at the top. Pappus of marginal achenes confluent, with a fringed cup.

Common, particularly in southern Qatar in sandy habitats. Flowering from February to April (Plate 104).

21. *PULICARIA GAERTN.*

Annual or perennial (ours) hairy herbs with alternate, sessile (ours), clasping leaves. Heads many-flowered. Flowers yellow. Ray-florets female, in one row, ligulate, or absent. Disc-florets perfect, tubular, 5-toothed. Involucral scales linear, densely imbricated. Receptacle naked. Achenes subterete or ribbed, beakless. Pappus in 2 rows, the outer very short, a small, denticulate or crenulate cup, persistent, the inner composed of scabrous bristles.

1. *Pulicaria undulata* *(L.) Kostel.* (1833); Boiss., Fl. Orient. 3: 202 (1875); Täckh., Stud. Fl. Egypt, ed. 2, 562 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 594 (1978).

Perennial herb, of aromatic scent, much branched, woolly procumbent. Leaves wavy, typically sessile, cut or toothed; the radical ones oblong, tapering at the base, those of the

stem linear–lanceolate, auricled-clasping. Heads terminal 15–20 cm in diameter. Ray-florets long, yellow (in other species short or absent). Peduncles rather long, scaly towards the tip. Involucral scales oblong–linear, acuminate, somewhat shorter than disc. Rays about twice as long as involucre.

Common in Qatar, particularly in central Qatar, in shallow depressions. It occurs with *Francoeuria crispa*, but *Francoeuria* is more common. Flowering in the summer months and early autumn. Local name. *Githgath* (the same name given to *Francoeuria crispa*) (Plates 103, 104).

22. *REICHARDIA ROTH.*

Annual or perennial herbs, with rosetted root and alternate stem-leaves. Heads on long peduncles. Florets yellow, all ligulate, fertile, 5-dentate at the tip. Involucre campanulate, the bracts in many rows, imbricate, the outer ones gradually shorter, swollen, scarious-margined. Receptacle flat, naked. Achenes of 2 kinds, inner ones pale, almost smooth, outer ones dark, tubercled rugose. Pappus sessile of simple hairs, connate at base in a ring and deciduous as a unit.

1. ***Reichardia tingtana*** *(L.) Roth*, Bot. Abh. 35 (1787); Zohary, Pal. Journ. Bot., Jer. Ser. 1, 3: 251 (1939) et Proc. Linn. Soc., Lond. 153, sess. 105 (1940–41); Täckh., Stud. Fl. Egypt, ed. 2, 604 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 544 (1978).

Picridium tirgitanum (L.) Desf., Fl. Atlant. 2: 220 (1799); Halwagy et Macksad. Bot. Journ. Linn. Soc. 65: 78 (1972).

Riechardia orientalis (L.) Hochr., Ann. Cons. Jard. Bot. Genève 7–8: 238 (1904); Rech., Fl. Lowland Iraq 682 (1964).

Annual herbs, 5–30 cm high, or dwarf, 3–5 cm (our variety var. *orientalis* (L.) Asch. et Schweinf.). Stems decumbent, thickened, sparingly branched. Leaves variously shaped, sessile, the uppermost smaller, undivided, cordate-clasping at base. Heads 1–2 cm long, pale yellow to orange, in the middle often blackish-red, on stout peduncles. Involucral scales imbricate, broadly white-margined, the outer one ovate, acuminate, black-mucronate at tip, the innermost oblong, obtuse. Ligules reddish at outer surface. Achenes tetragonous, 4-furrowed, truncate at base and tip, transversely and obtusely rugose-tubercled.

Common in Qatar on sandy soil. Flowering from February to April (Plate 106).

23. *RHANTERIUM L.*

Rigid, much-branched desert shrubs, with white-fleecy stems and branches. Leaves linear or linear–oblong, greenish, sparsely hispid. Heads many-flowered. Female florets narrow ligulate. Involucral bracts coriaceous, glabrous, in several rows, the outermost very short, the inner ones linear–lanceolate, acute. Receptacle chaffy. Achenes narrow, glabrous. Pappus absent.

1. ***Rhanterium epapposum*** *Oliv.*, Ic. Pl. 1367; Blatt., Fl. Arab. 2: 248 (1921); Zohary, Proc. Linn. Soc., Lond. 153, sess. 104 (1940–41); Rech., Fl. Lowland Iraq 609 (1964); Migahid, Fl. Saudi Arab., ed. 2, 1: 568 (1978).

Shrublet, whitish-canescent, much branched from the base; branches slender, intricate, usually somewhat spinescent at length. Leaves remote, few, linear or narow–ovate, remotely dentate or entire, sparsely long—hairy or glabrous. Heads solitary, terminal, 0·8–1·2 cm wide, pedunculate. Involucral scales lanceolate–linear, acute, leathery, glabrous, in several rows, gradually increasing from the outer to the inner ones. Receptacle chaffy. Female flowers narrow ligulate. Achenes narrow, glabrous, bald. Pappus absent.

Common in southern Qatar. It dominates a plant community along the road from Wukair to Kharrarah; in the shallow sandy runnels. It would be much more common in southern Qatar, were it less exploited. The plant is an important grazing plant. Flowering from April to July. Local name: *Arfaj*, a name used in the Arabian peninsula and Iraq for the same species (Plates 105, 106).

24. *SENECIO* L.

Annual (ours) or perennial herbs. Leaves alternate, undivided or pinnati- or bipinnatisect. Heads in corymbose panicle or terminal or axillary, corymbose clusters. Flowers bright yellow (ours). Ray-florets in one row, female, ligulate. Disc-florets hermaphrodite tubular. Involucral scales obconical–cuplike, inner row of linear bracts, outer one very short, squamulose. Receptacle flat, naked. Achenes beakless, cylindrical, furrowed and ribbed. Pappus of simple hairs, in more than one row, deciduous or persistent.

I. Ray-florets elongate, about as long as the involucre. Pappus deciduous . . . 1. *S. desfontainei*
II. Ray-florets none, or much shorter than the involucre. Pappus persistent . . . . 2. *S. vulgaris*

1. *Senecio desfontainei* *Druce*, Brit. pl. List, ed. 2, 61 (1928); Rech., Fl. Lowland Iraq 632 (1964); Halwagy et Macksad, Bot. Journ. Linn. Soc. 65: 78 (1972); Täckh., Stud. Fl. Egypt, ed. 2, 581, t. 207 (1974) Migahid, Fl. Saudi Arab., ed. 2, 1: 619 (1978).
S. coronopifolius Desf., Fl. Atlant. 2: 273 (1799); Boiss., Fl. Orient. 3: 390 (1875).
S. gallicus Chaix in Vill., Hist. Pl. Dauph. 1: 371 (1786).

Annual glabrescent herb. Leaves fleshy, pinnatipartite into linear, remotely toothed lobes, the lower ones tapering into a short petiole, the upper ones sessile, clasping at base. Heads 1 cm long, on rather long peduncles, in loose, terminal or axillary corymbose clusters. Involucre glabrous, the inner bracts green, linear, acuminate, the outer very short. Ray-florets about as long as the involucre. Achenes oblong–cylindrical, about 2 mm long, short adpressed hairy, ribbed. Pappus deciduous.

Rare in Qatar; the plant grows in *rodat*, especially cultivated ones. Flowering from February to April. Local name: *Zimloog* is the name given to the plant in the Zor Hills by Carter (1917); *Murier* is the name given in Blatter (1921).

2. *Senecio vulgaris* *L.*, Sp. Plant., ed. 1, 867 (1753): Rech., Fl. Lowland Iraq 632 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 583, t. 207 (1974).

Annual herb. Lower leaves short-petioled, oblong–spathulate, dentate, the upper ones pinnati- or bipinnatipartite, sessile, auriculate and somewhat clasping at base, with rather remote, ovate, obtuse segments. Heads about 7 mm long, obconical–cylindrical, in more or less dense, terminal or axillary, corymbose clusters. Involucral scales glabrous, the

outer very short, black-tipped. Ray-florets absent or very short. Achenes densely hairy on the ribs. Pappus white, long, persistent.

Rare in Qatar; the plant grows as a weed in irrigated localities. Flowering from March to April.

25. *SONCHUS L.*

Annual, biennial or perinnial herbs. Leaves usually runcinate–pinnatifid, rarely simple, sinuate–dentate leaves. Heads with many bisexual yellow ligulate florets. Involucre ovoid, with imbricate bracts, becoming conical often flowering. Receptacle naked. Achenes compressed, attenuated at both ends, 1–3-ribbed. Pappus of 2 types of hairs: solitary rough deciduous hairs, and more persistent softer hairs in clusters.

I. Achenes smooth, thin, papery, winged. Leaves with rounded auricles. 1. *S. asper*
II. Achenes wrinkled, rather thick when ripe, wingless. Leaves with pointed auricles.
  1. Achenes longitudinally 3-ribbed, abruptly narrowed at base. Ligule longer than corolla tube. Lower leaves only petiolate . . . . 2. *S. oleraceous*
  2. Achenes longitudinally many-striate, gradually narrowed at base. Ligule about as long as corolla tube. Nearly all leaves petiolate . 3. *S. tenerrimus*

1. *Sonchus asper* *(L.) Hill.*, Brit. Herb. 1: 47 (1756); Rech., Fl. Lowland Iraq 678 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 608 (1974).

Annual, glabrous herb, glandular above. Lower leaves usually spathulate, entire, upper ones pinnatified to pinnatisect, margin sharply dentate. Heads 14–18 mm in diameter in flower, in a cymose, subumbellate panicle. Involucral bracts linear–lanceolate, floccose near base, glabrous at length. Ligule and corolla tube of about equal length. Achenes obovate–oblong, broad-margined, smooth, remotely 3-nerved, thin, papery, 2–3·75 mm long.

Rare in Qatar; recorded as a weed in the cultivated *rodat*. Flowering from March to May.

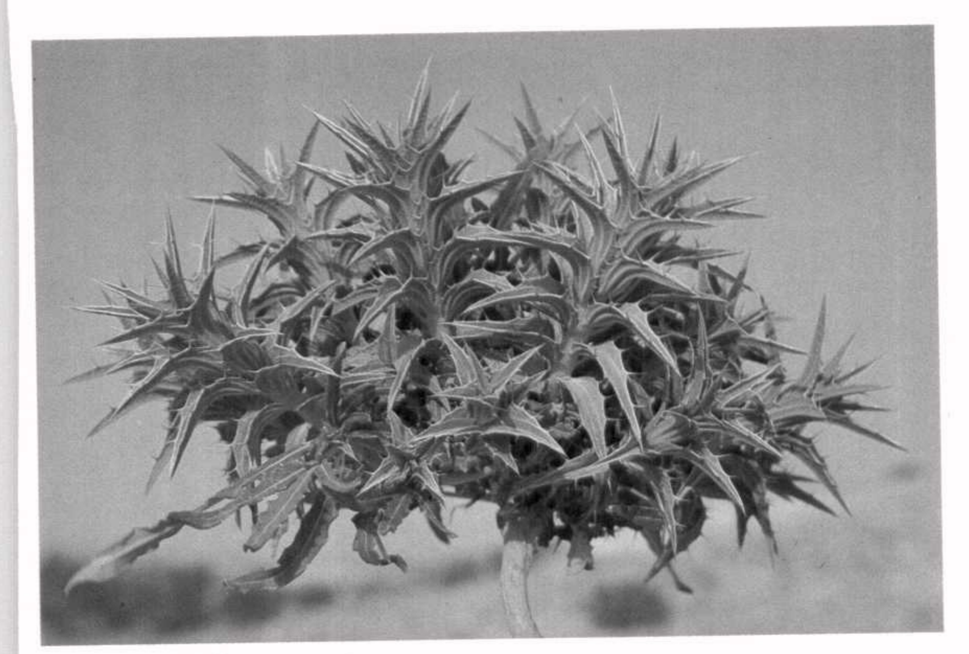
2. *Sonchus oleraceous* *L.*, Sp. Plant., ed. 1, 794 (1753); Rech., Fl. Lowland Iraq 678 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 608 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 545 (1978).

Annual or biennial, glabrous herb, with erect stems; the young branches with glandular hairs, soft, hollow and leaf milky-juiced. Leaves alternate, pinnatisect, lyrate to runcinate. Upper leaves sessile, narrow, clasping the stem with pointed auricles. Heads 10–20 × 6–30 mm, in a cymose, subumbellate panicle. Involucral bracts in 3–4 rows, oblong–lanceolate, the outer shorter than the middle ones. Flowers all ligulate. Achenes obovate–oblong, narrow-margined, longitudinally 3-ribbed, wrinkled. Pappus white, about 6 mm long.

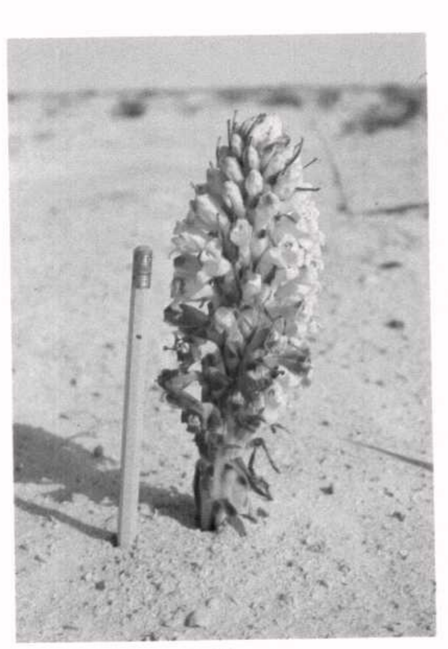
Common in Qatar, growing as weed in cultivated land as well as in moist habitats. Flowering in the spring. Local name: *Odeid* (Plate 106).

3. *Sonchus tenerrimus* *L.*, Sp. Plant. 794 (1753); Rech., Fl. Lowland Iraq 679 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 608 (1978).

Annual or biennial, glabrous herb. Leaves glabrous, pinnatifid to pinnatisect, lobes



Blepharis ciliaris (L.) Burtt.

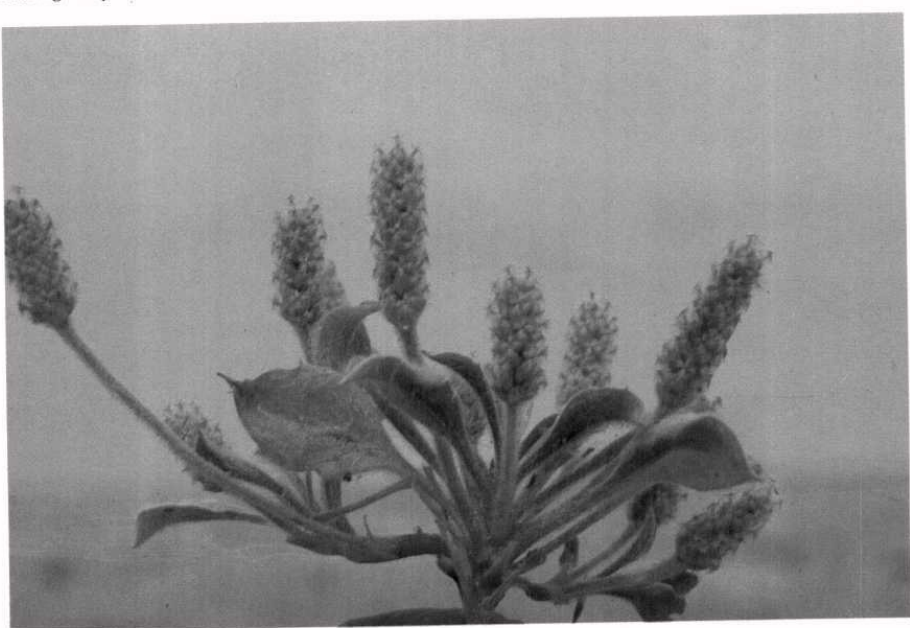




Cistanche phelypaea (L.) Cout.

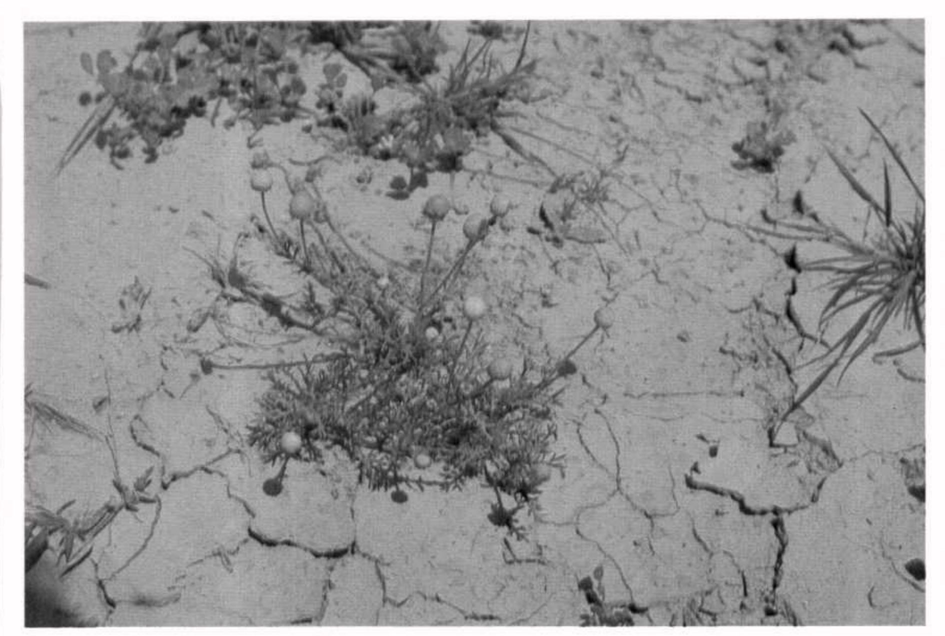


Plantago amplexicaulis Cav.

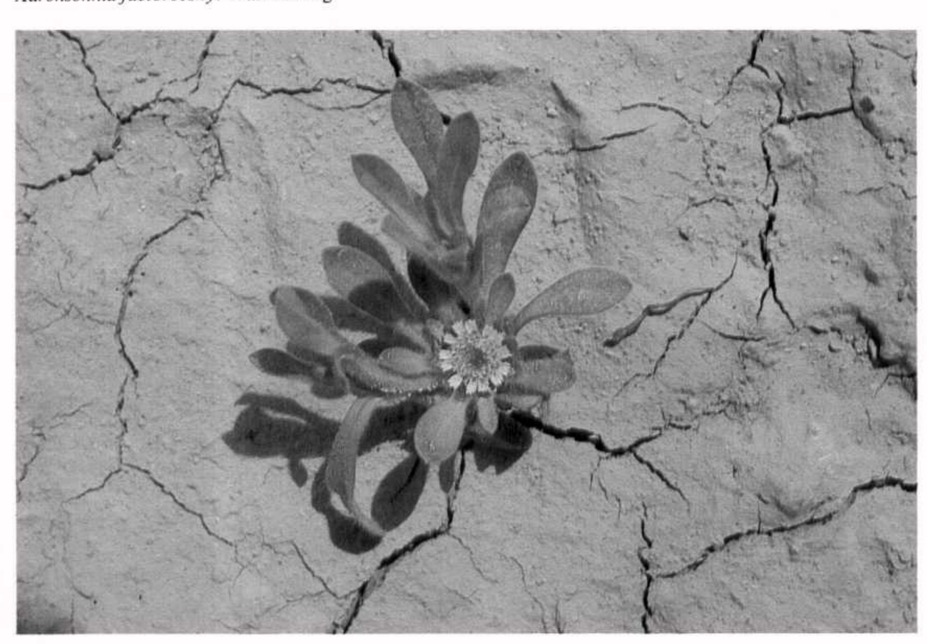


Plantago ciliata Desf.

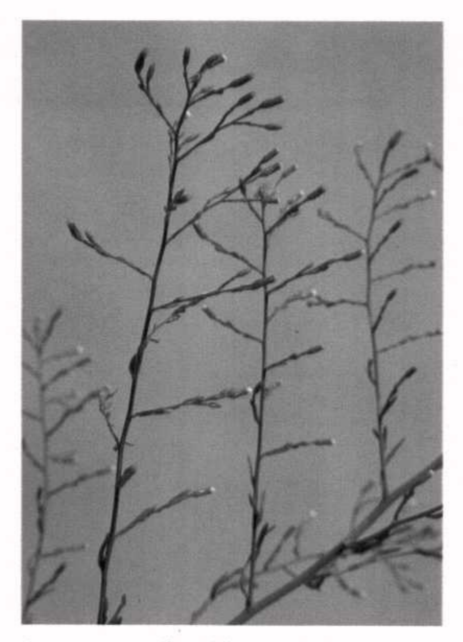
PLATE 94



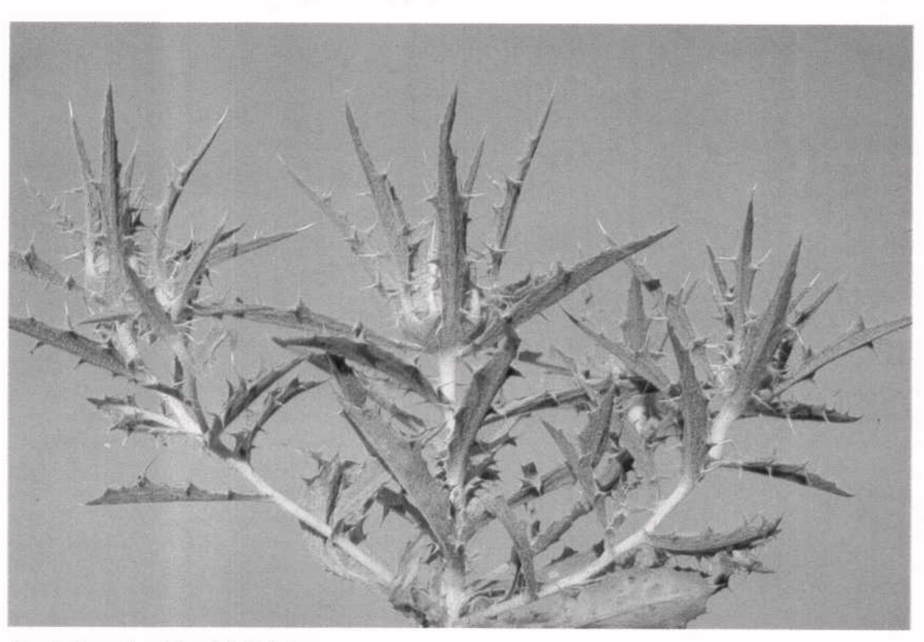
Aaronsohnia factorovskyi Warb. et Eig.



Asteriscus pygmaeus (DC.) Coss. et Dur.



Aster squamatus (Spr.) Hieron ex Sod.



Atractylis carduus (Forssk.) Christens.

PLATE 96

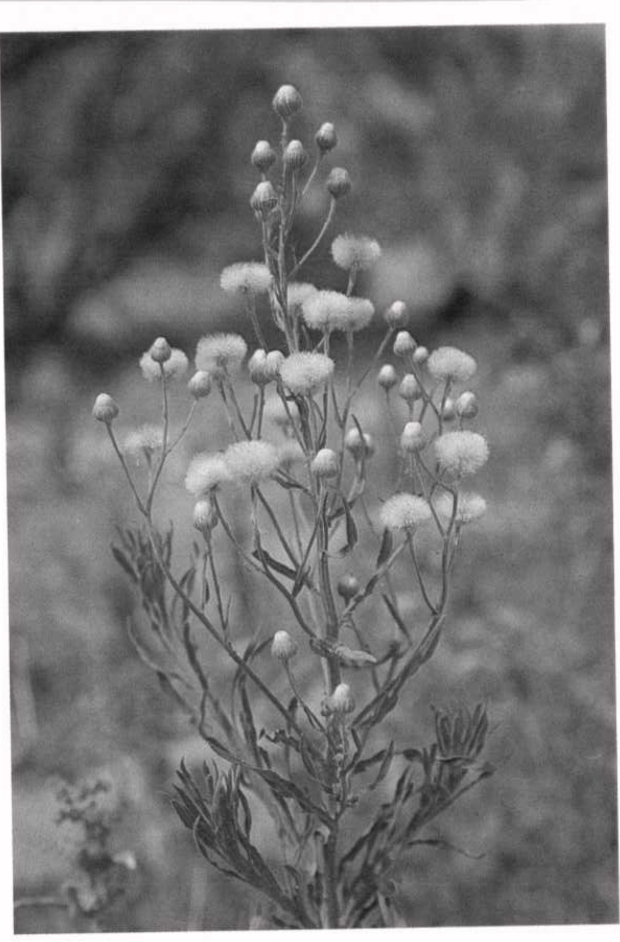
PLATE 97



Calendula arvensis L.



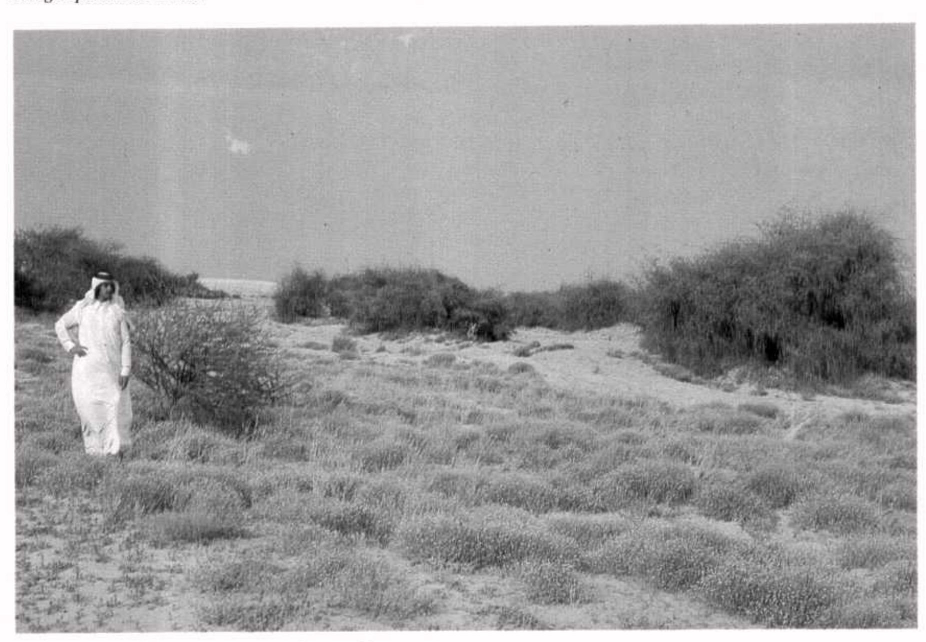
Centaurea sinaica DC.



Conyza bonariensis (L.) Cronquist.

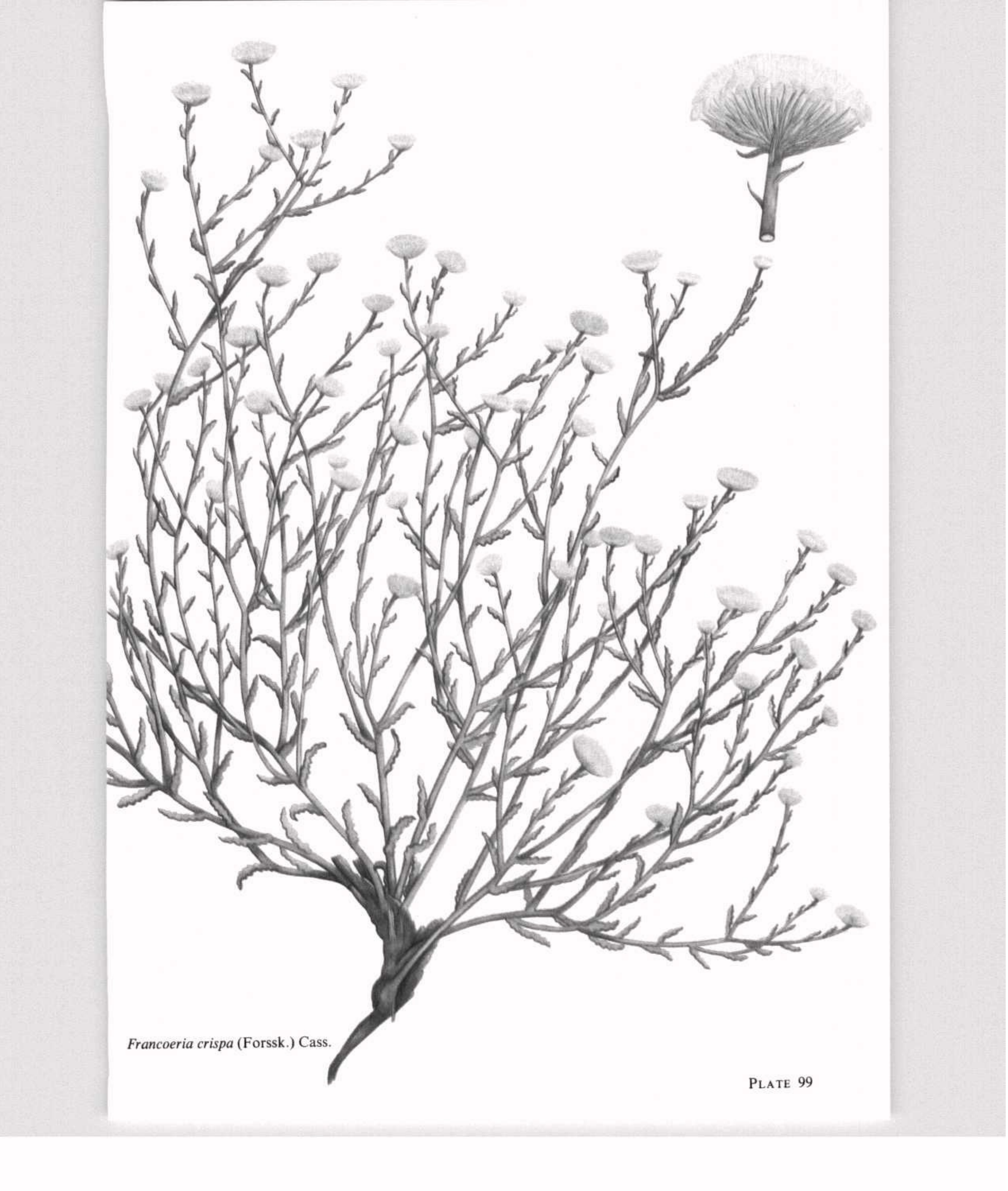


Filago spathulata Presl.

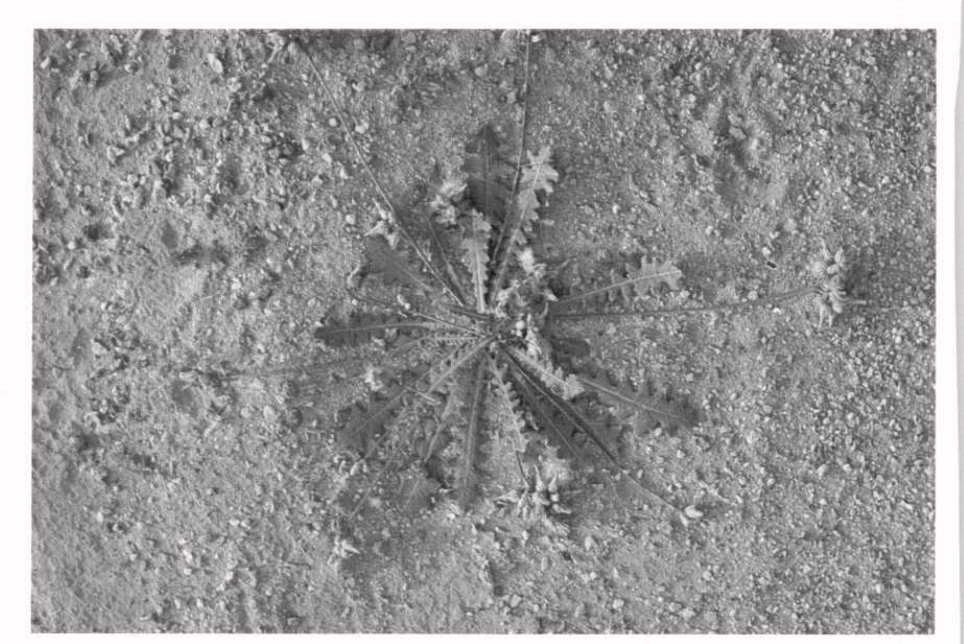


Dense growth of *Francoeria crispa* in a *roda*.

PLATE 98



Francoeria crispa (Forssk.) Cass.

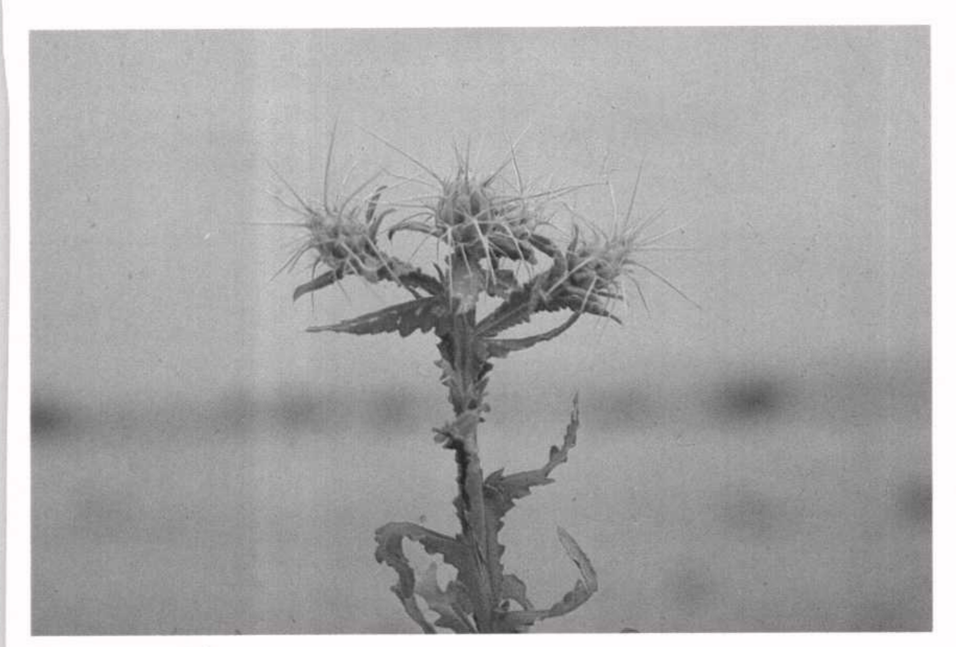


Launaea capitata (Spreng.) Dandy.

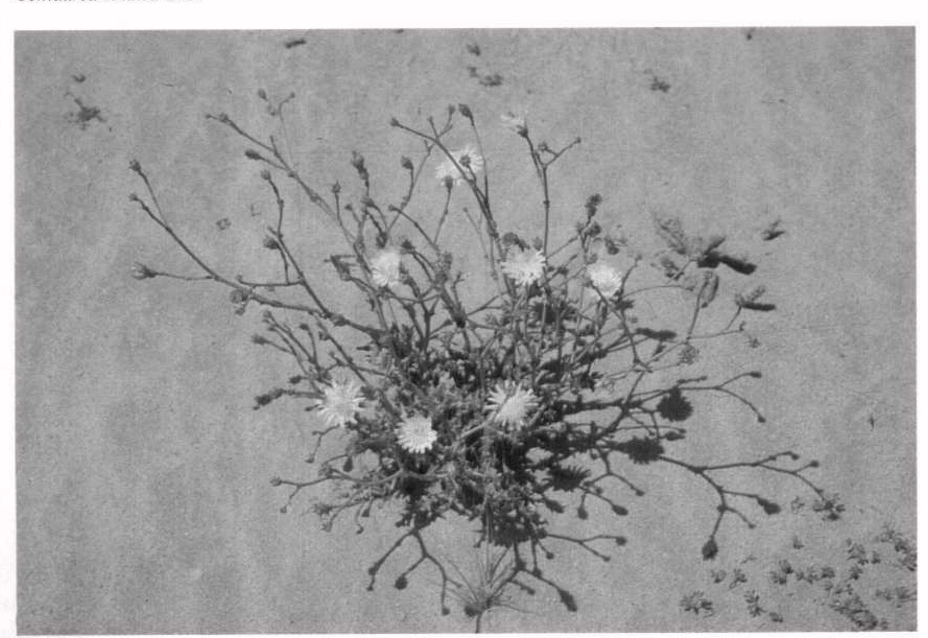


Launaea procumbens (Roxb). Ramayya et Rajagopal.

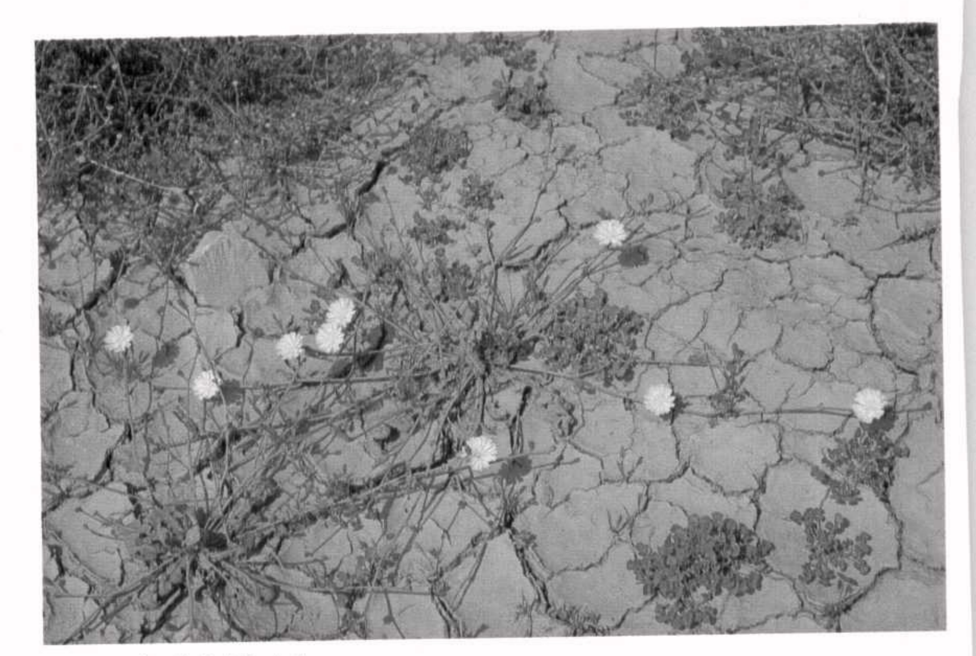
PLATE 100



Centaurea sinaica DC.



Launaea cassiniana (Jaub. et Spach) Burkill.

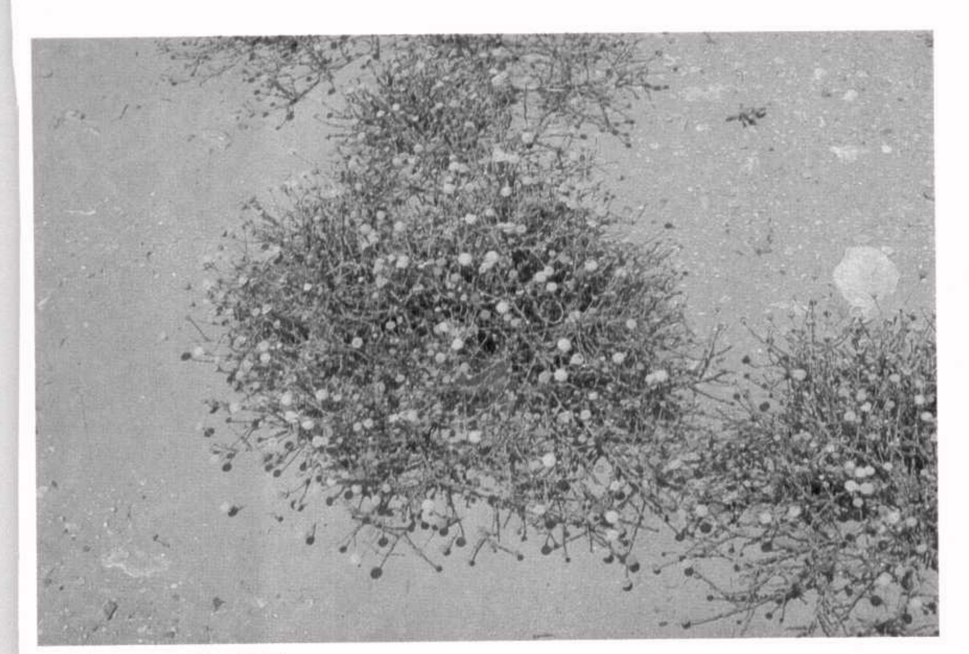


Launaea nudicaulis (L.) Hook. f.

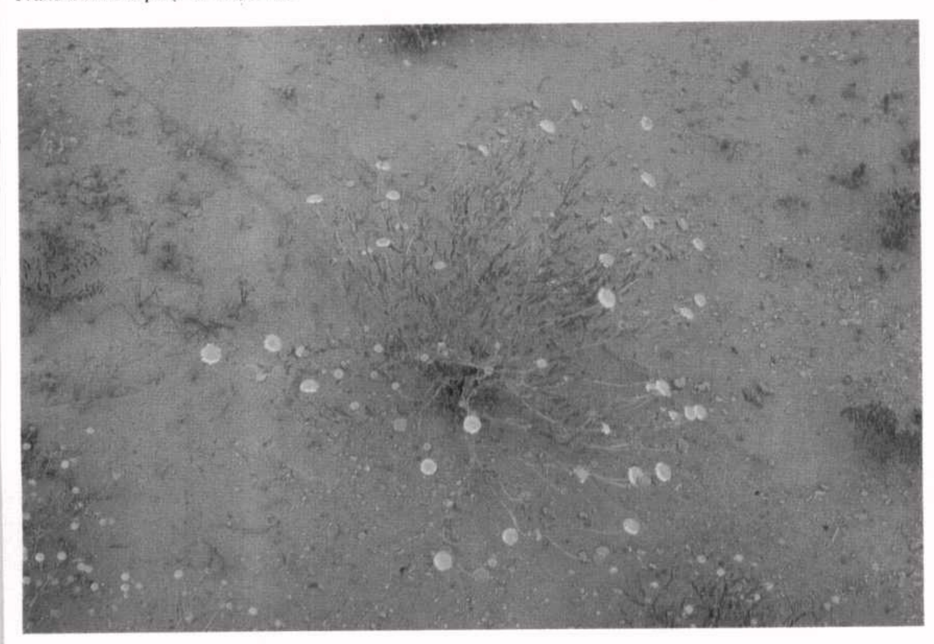


Launaea nudicaulis (L.) Hook. f.

PLATE 102



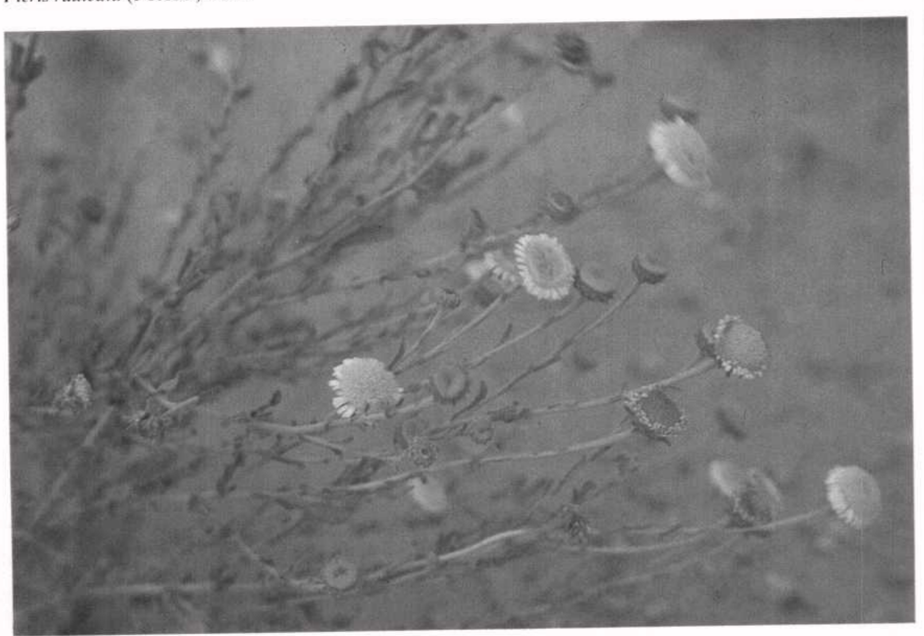
Francoeuria crispa (Forssk.) Cass.



Pulicaria undulata (L.) Kostel.

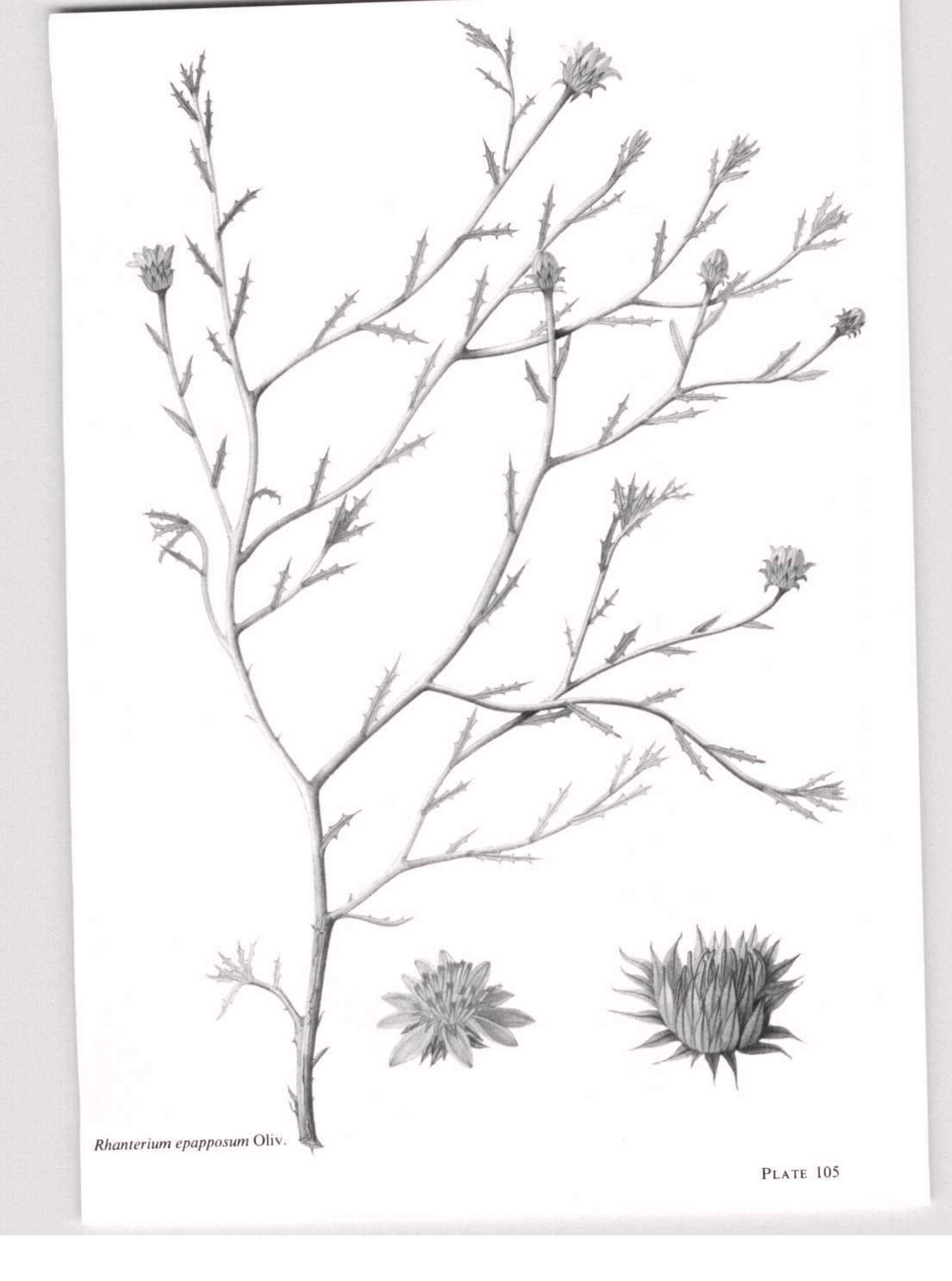


Picris radicata (Forssk.) Less.



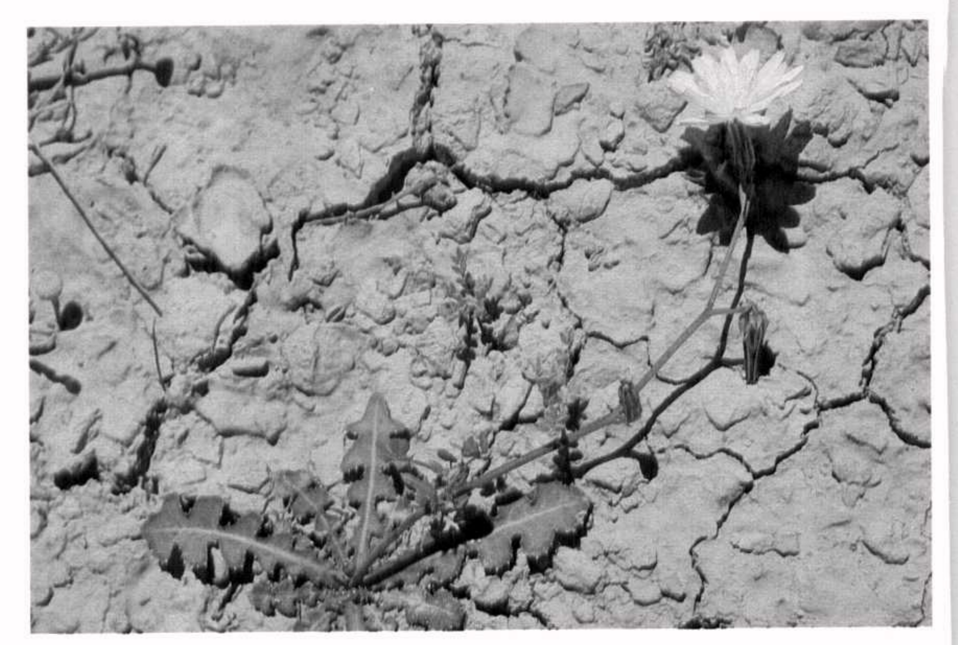
Pulicaria undulata (L.) Kostel.

PLATE 104



Rhanterium epapposum Oliv.

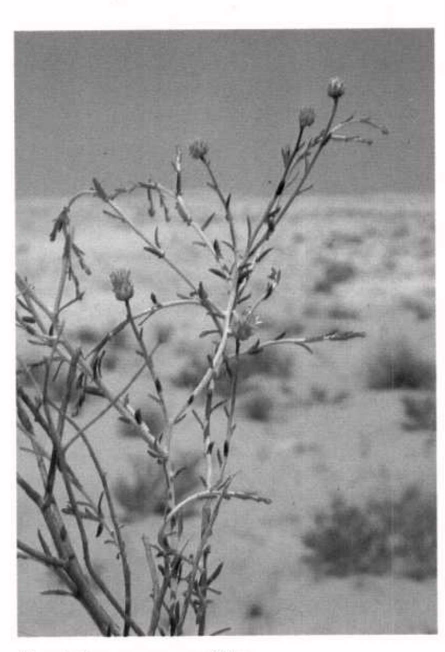
PLATE 105



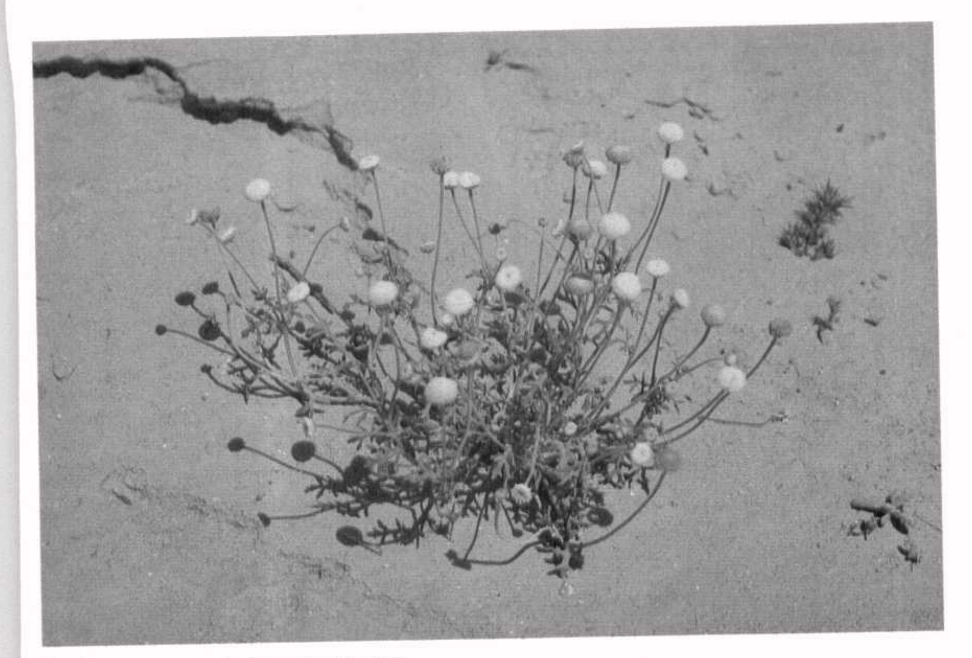
Reichardia tingtana (L.) Roth.



Sonchus oleraceous L.



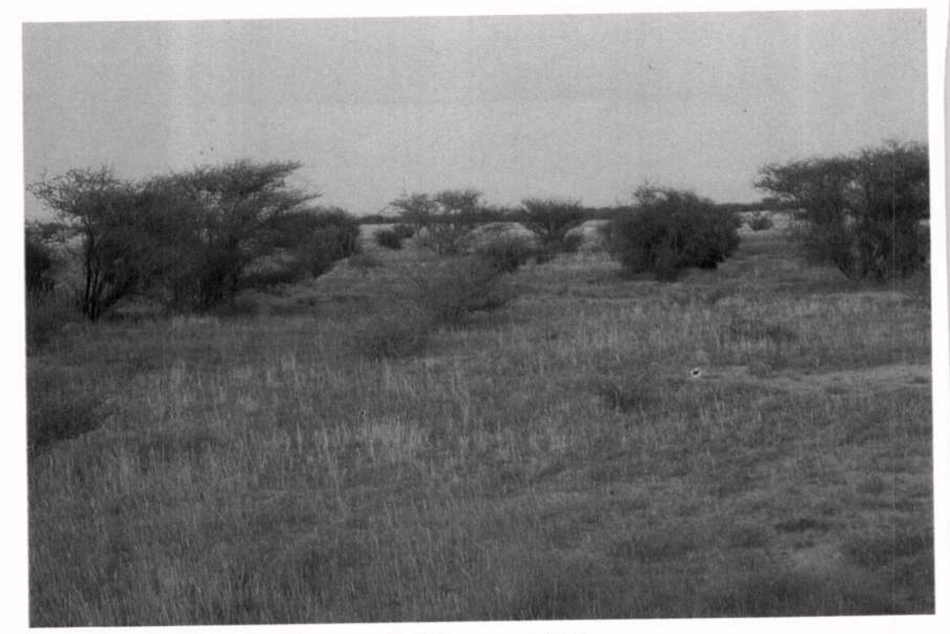
Rhanterium epapposum Oliv.



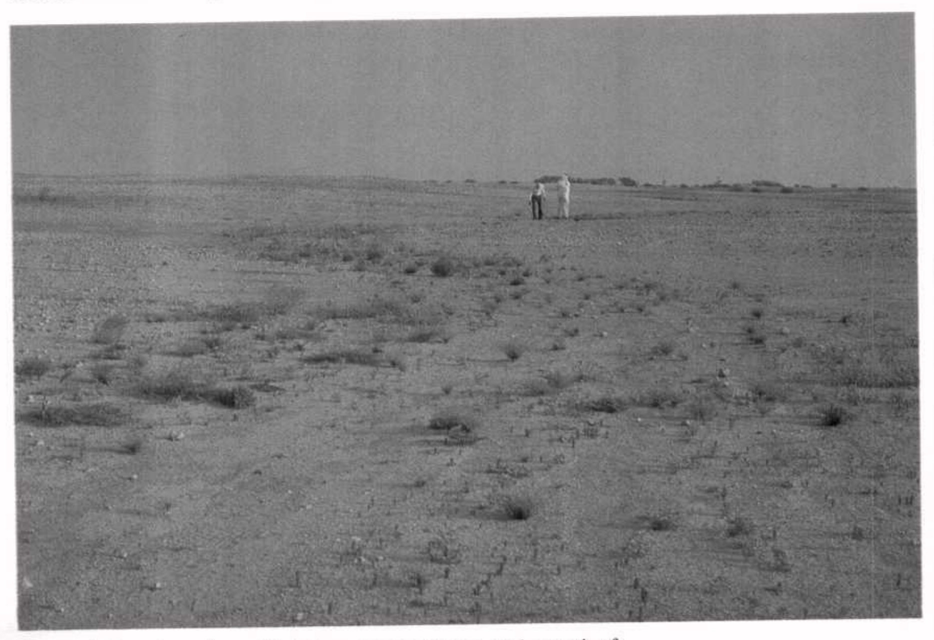
Tripleurospermum auriculatum (Boiss). Rech.



Vicoa pentanema Aitch. et Hemsl.



Acacia tortilis community with dense growth of *Stipa capensis* (dry).



A runnel dissecting a *hazm*. Note the absence of trees, and growth of *Helianthemum lippii, Glossonema edule* and *Ifloga spicata*.

PLATE 108

variable in shape but always constricted at base. Upper leaves sessile, gradually smaller, clasping the stem with long-pointed auricles. Heads 10–20 mm in diameter in flower, in a few-headed, short corymbose panicle. Involucral bracts linear–lanceolate, floccose at base, glabrous at length, turning black. Achenes 2·5–3·3 × 5·0–12·0 mm, narrowly oblanceolate, abruptly narrowed at apex, longitudinally many-striate.

Rare in Qatar; it grows as a weed in *roadt* with regularly irrigated cultivations. Flowering from April to May.

26. *TRIPLEUROSPERMUM* SCH.-BIP.

Small, glabrous annual herbs. Leaves finely dissected, with filiform–subulate lobes. Heads discoid hemispherical, yellow, with scarious-margined scales, 0·8–1·5 cm in diameter. Achenes ribbed, crowned by oblong, translucent wing, as long as or longer than the achene.

1. ***Tripleurospermum auriculatum*** *(Boiss.) Rech.*, Ber. deutsch. Bot. Ges. 72, 277 (1959) et Fl. Lowland Iraq 629 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 577 (1974); Migahid, Fl. Saudi Arab., ed. 2, 1: 620 (1978).

Chamaemelum auriculatum Boiss., Diagn. Pl., Ser. 1, 11: 23 (1849). *Matricaria auriculata (Boiss.) Muschl.*, Man. Fl. Egypt, 2: 1011 (1912).

Annual, 10–25 cm high, glabrous. Stems ascending, unbranched or diffusely branched from the base, the branches 1-headed. Leaves ovate–oblong in outline, bipinnatisect, with finely dissected lobes, cut into narrow linear or filiform, subulate lobulets. Heads 0·8–1·2 cm in diameter, discoid. Involucral scales broadly scarious-margined. Receptacle ovate. Achene auricled; crown oblong, as long as the achene or longer.

Occasional in Qatar, particularly in *rodat* of northern and central Qatar. Flowering from March to April (Plate 107).

27. *VICOA* CASS.

Annual (ours), sparsely hairy, with alternate, simple entire leaves. Heads terminal, solitary or on leaf-opposed peduncles. Ray-florets female; disc-florets hermaphrodite. Involucral bracts imbricated, many-seriate. Achenes subterete, hardly ribbed. Pappus in 1 row of 5, or 10, rarely 20 bristles, unequal.

1. ***Vicoa pentanema*** *Aitch. et Hemsl.*; Rech., Fl. Lowland Iraq 605 (1964).

Inula divericata (Cass.) Boiss. *Pentanema divericatum* Jaub. et Spach, non *Vicoa divericata* Oliv.

Small, annual, sparsely hairy, dichotomously and divericately branching from the base; the branches thin, purplish. Leaves membranous, oblong or ovate, entire, the lower ones tapering towards base, the upper ones rounded or cordate at base. Heads numerous, 6–7 mm across, axillary and terminal, globose, on long thin leafless peduncles Involucral bracts densely woolly, narrowly linear lanceolate, acute, of various lengths. Ray-florets hardly longer than the disc ones. Pappus hairs 5, stiff, scabrid, 3 times as long as the achene.

Occasional in Qatar; it occurs on fine shallow deposits particularly in *rodat*. The plant has been observed locally abundant in Al-Magdah. Flowering from March to May (Plate 107).

28. *XANTHIUM L.*

Annual (ours) monoecious herbs, with alternate, 3-cleft or palmately-lobed leaves. Heads sessile, solitary or racemed, of 2 kinds, upper male and lower female. Male heads globular, with 5-toothed flowers and involucre of several bracts. Female heads ovate, 2-flowered, with gamophyllous involucre, later forming a large ovoid fruit, covered with hooked prickles and at tip in some species with 2 rigid spinescent beaks.

1. *Xanthium spinosum* *L.*, Sp. Plant. 987 (1753); Täckh., Stud. Fl. Egypt, ed. 2, 568 (1974).

A richly branched annual robust herb. Stem with long, yellow, 3-fid spines near the leaf axils. Leaves beneath white-felty, cuneate-based, 3-cleft with a long, narrow mid-lobe. Heads sessile, solitary in the leaf axils. Female heads ovate, forming a large ovoid fruit densely covered with hooked bristles.

Rare in Qatar; it grows as a weed in cultivated land. Flowering in the late summer.

MONOCOTYLEDONEAE

50. *HYDROCHARITACEAE A. JUSS.*

Aquatic herbs with alternate, paired or whorled leaves. Flowers solitary or cymose-panicled, enclosed in 1–2 bracts. Perianth regular, 3-merous, usually differentiated into a calyx and corolla. Stamens in 1–5 whorles, the inner often staminodes; ovary inferior of 2–15 carpels, 1-loculed with parietal placentation and numerous ovules.

1. *HALOPHILA THOU.*

Submerged marine plants with small leaves in pairs from a creeping rhizome. Flowers dioecious, small, included in a sheath, the male ones peduncled with 3 stamens, the female ones sessile.

1. *Halophila stipulacea* *(Forssk.) Asch.*, Sitzb. Naturf. Fr. Berlin 3 (1867); Boiss., Fl. Orient. 5: 3 (1882); Täckh. et Drar, Fl. Egypt, 1: 122 (1941).

A rhizomatous submerged plant of whitish apearance. Leaves linear oblong, about 1 cm broad, 4–5 cm long, short-petioled, included in broad, obtuse, folded sheaths of white colour.

The plant grows in shallow waters along the sandy shores (Plate 109).

51. *LILIACEAE A. JUSS.*

Herbs with bulb or rhizome, less frequently trees or shrubs. Leaves alternate, or whorled

or all radical. Flowers mostly racemose. Perianth regular, the 2 whorls petaloid. Stamens 6 in 2 whorls. Ovary superior, usually 3-loculed, with axile placentation. Fruit a capsule (our species) or a berry.

1. Root fibrous, leaves fistulose . . 1. *Asphodelus*
2. Bulbous plants; leaves linear. . . 2. *Dipcadi*

1. *ASPHODELUS* L.

Annual (our species) or perennial herbs, with roots consisting of clustered spindle-shaped tubers or slender fibres. Scape leafless, with panicled or racemed flowers, the pedicels jointed above or near their middle. Perianth segments free, pink or white with green or reddish midrib.

1. *Asphodelus fistulosus* *L.* var. ***tenuifolius*** *Cav.* (1824); Täckh. et Drar, Fl. Egypt, 3: 47–48 (1954).

Asphodelus fistulosus Forssk., Fl. Aegypt.-Arab. (1775). *A. tenuifolius* Cav. (1801), Rech., Fl. Lowland Iraq 145 (1964). *A. tenuifolius* var. *micranthus* Boiss., Fl. Orient. 5: 314 (1882).

Small or medium-sized annual herb. Leaves rosetted, semiterete, fistulose, shorter than scape, scabrid near base on margins. Scape simple or dichotomously branched, usually scabrid near base. Bracts triangular, acuminate. Pedicels jointed below middle. Flowers in a lax panicle, small, white, usually with a red, orange or bluish band at the back of the perianth segments.

The plant is common in Qatar and grows in depressions. Flowering is mainly in the early spring. Local name: *Barwag* (Plate 109).

2. *DIPCADI* MEDIK.

Bulbous herbs with linear, fleshy radical leaves and flowers in a 1-sided raceme. Flowers mostly brown grey-pruinose; perianth deeply cleft, in our species with the 3 outer lobes longer and spreading, the 3 inner ones shorter and erect, all acute. Bracts lanceolate or deltoid and acuminate or clawed. Capsule 3-valved with black compressed seeds.

1. *Dipcadi erythreum* *Webb et Berth.*, Phyto. Canar. 3: 341 (1848); Täckh. et Drar, Fl. Egypt, 3: 161 (1954); Migahid, Fl. Saudi Arab., ed. 2, 2: 652 (1978); Dasgupta, Journ. Bombay Nat. Hist. Soc. 75: 53 (1978) *Uropetalum erythreum* Boiss., Fl. Orient. 5: 286 (1882).

A bulbous perennial small herb. Bulb grey, about as large as a walnut. Leaves radical, narrow, linear, fleshy, as long as or larger than the scape, usually prostrate on the ground surface. Raceme 6–12-flowered with 12–15 mm long flowers. Bracts scarious, acute, about $2\frac{1}{2}$ times as long as the pedicels. Capsule large, deeply 3-grooved.

The plant is frequent in Qatar, particularly in southern Qatar. It grows on sandy and loamy soils in depressions. Flowering in the early spring. Local name: *Mesilmo* (Plate 109).

52 *JUNCACEAE A. JUSS.*

Grass-like or sedge-like herbs with creeping rhizomes and erect unbranched stems. Leaves grass-like or cylindrical, sometimes reduced to membranous sheaths. Flowers small, brownish, aggregated in terminal or lateral cymes. Perianth glumaceous, 6-parted. Stamens 6 or 3. Ovary superior, with 3 parietal placentae. Style 1 with 3 stigmas. Fruit a 3-valved capsule.

1. *JUNCUS L.*

Marsh perennial (our species) with sympodial rhizome, developing 1 leafy shoot every year. Culm typically unbranched. Leaves absent, or if present, cylindrical or grooved with cleft sheaths. Inflorescence terminal or seemingly lateral with usually leaf-like subtending bract, in the later case the culm is continued above the inflorescence by a culm-like leaf. Perianth 6-segmented; stamens 6. Fruit a many-seeded capsule.

1. *Juncus rigidus* *C. A. Mey.*, Täckh., Stud. Fl. Egypt, ed. 2, 664 (1974).
J. arabicus (Asch. et Buch.) Adams, J. Linn. Soc. Bot. 50: 10 (1935) *J. maritimus* var. *arabicus* Asch. et Buch. ex Boiss., Fl. Orient. 5: 354 (1884).

A pale green herb, with erect parallel culms, whether tufted or in rows from a creeping rhizome. Leaves terete, nodeless. Culms at base with a few pungent leaves. Flowers in an open lateral cyme, the culm is continued above the inflorescence by a culm-like leaf. Capsule longer than broad, only little exceeding the perianth. Seeds with a short white tail.

The plant is recorded in the littoral salt marshes near Al Dhakhirah, Abu Samrah and at Al-Wabrah. It flowers in the late spring.

53. *GRAMINEAE A. JUSS.*

Annual or perennial herbs, rarely woody, with jointed culms, erect or geniculate at the base, solid at the nodes, with hollow cylindrical internodes. Leaves arranged in 2 ranks, ligulate with split sheaths. Flowers in spikelets, each spikelet with 2 empty glumes below, then on several lemmas (fertile glumes), each carrying in its axis a naked flower. Spikelets arranged in various compound inflorescences. Stamens 1 (*Vulpia*), 6 (*Oryza*), usually 3. Ovary 1-celled, 1-ovuled, superior, with 2 feathery stigmas. Fruit a caryopsis.

I. INFLORESCENCE A HEAD-LIKE, SOLITAR, TERMINAL PANICLE
- A. Perennial creeping grass with string-like culm, richly branched at the node . . . . 1. *Aeluropus*
- B. Annual erect grasses.
  - 1. Leaf-sheaths glabrous, awns absent . . . . 29. *Phalaris*
  - 2. Leaf-sheaths hairy, lemma awned.
    - a. Spikelets very small, mostly a few millimetres . . . 26. *Lophochloa*
    - b. Spikelets large . . . . 6. *Bromus*

II. INFLORESCENCE A SPIKE-LIKE PANICLE
A. Spikes or spike-like panicles 2 or several together.
1. Each pair of spikes embraced at its base by a spathaceous sheath, aromatic plants . . . . 11. *Cymbopogon*
2. Spikes forming a naked inflorescence, plants not aromatic.
a. Spikes racemed.
o. Racemes ascending, 6 cm long, spikelets spaced, steel grey . . . . 16. *Diplachne*
oo. Racemes much shorter . . . . 17. *Echinochloa*
b. Spikes digitate or subdigitate.
o. Spikes awned.
x. Awns kneed . . . . 14. *Dichanthium*
xx. Awns straight . . . . 8. *Chloris*
oo. Spikelets awnless.
x. Spike 1–2 mm broad.
· Ligule scarious . . . . 15. *Digitaria*
·· Ligule a fringe of hairs . . . . 12. *Cynodon*
xx. Spike broader.
· Spike terminated by the naked tip of the rachis . . . . 13. *Dactyloctenium*
·· Spike terminated by a spikelet . . . . . 18. *Eleusine*
B. Spike or spike-like panicle, solitary terminal.
1. Spikelets irregularly arranged, not in ranks.
a. Spikelets or spikelet-clusters with an involucre of numerous bristles at base.
o. Bristles persistent on the pedicel after the shedding of the spikelet . . . . 34. *Setaria*
oo. Bristles deciduous with the spikelet.
x. Bristles connate at base . . . . 7. *Cenchrus*
xx. Bristles not connate at base . . . . . . 28. *Pennisetum*
b. Spikelets without bristles.
o. Perennial grasses.
x. Culm creeping, string-like, richly branched at the nodes . . . . 1. *Aeluropus*
xx. Culms tufted, erect.
· Spike 20 cm long or more . . . . . . 21. *Halopyrum*
·· Spike much shorter.
– Spike, soft, silky, with exerted long awns . . . . 20. *Eremopogon*
= Spike stiff, with included short awns . . 4. *Asthenatherum*
oo. Annual grasses.
x. Spikelets several-flowered.
· Spikelets awned.
– Spikelets numerous, small . . . . . 26. *Lophocloa*
= Spikelets few, very large . . . . . 39. *Trachynia*
·· Spikelets awnless.
– Glumes much shorter than lemmas . . 19. *Eragrostis*
= Glumes including the lemmas or nearly so . . . . 33. *Schismus*
xx. Spikelets 1-flowered.
· Spikelets awned, spike soft . . . . . . 32. *Polypogon*
·· Spikelets awnless, spike stiff . . . . . 29. *Phalaris*

2. Spikelets in 2 or more ranks.
 a. Spikelets white-silky . . . . 24. *Lasiurus*
 b. Spikelets green.
  o. Spike narrow, culm-like, with spikelets sunk in the hollows of the excavated rachis . . . . . . 22. *Henrardia*
  oo. Not so.
   Spike lax, 2-sided with remote spikelets.
    · Spikelets rarely more than 3–4.
     – Spikelets awnless . . . . 10. *Cutandia*
     = Spikelets awned . . . . 39. *Trachynia*
    ·· Spikelets more . . . . 25. *Lolium*
   xx. Spikes dense, 2- or more-sided with approximate spikelets . . . . 23. *Hordeum*

III. INFLORESCENCE AN OPEN, NOT SPIKE-LIKE PANICLE OF PEDICELLED SPIKELETS
A. Spikelets awned.
 1. Lemma with one 3-parted awn.
  a. The 3 branches naked . . . . 2. *Aristida*
  b. At least one of them plumose . . . . 38. *Stipagrostis*
 2. Not so.
  a. Awns very short, not exerted from the spikelet . . . 4. *Asthenatherum*
  b. Awns exerted.
   o. Awns at least 6 cm long . . . . 37. *Stipa*
   oo. Awns shorter.
    x. Spikelets in threes . . . . 9. *Chrysopogon*
    xx. Spikelets in pairs of 1 sessile and 1 pedicelled together . . . . 35. *Sorghum*
    xxx. Spikelets solitary.
     · Spikelets 1-flowered . . . . 32. *Polypogon*
     ·· Spikelets 2 to many-flowered.
      – Spikelets 1 cm long or more (except awns).
       + Glumes scarious, including the lemmas . . 5. *Avena*
       + + Glumes herbaceous, shorter than the lemmas 6. *Bromus*
      = Spikelets small. . . . . 26. *Lophochloa*
B. Spikelets awnless
 1. Tall perennial grasses with hairy panicles.
  a. Panicles dense ovoid, lemmas with long, silky hairs . . 3. *Arundo*
  b. Panicle 1-sided, acute, spikelets inside with long hairs on the rachilla, lemmas glabrous . . . . 30. *Phragmites*
 2. Not so.
  a. Spikelets 1-flowered (lower floret in *Panicum* not evident).
   o. Panicle silky; dense panicle . . . . 32. *Polypogon*
   oo. Not so
    x. Spikelets minute, leaves long almost pungent. . 36. *Sporobolus*
    xx. Spikelets globose, leaves short, not pungent . . 27. *Panicum*
  b. Spikelets 2 to many-flowered
   o. Ligules absent or replaced by a fringe of hairs
    x. Glumes including the lemmas or nearly so . . 33. *Schismus*
    xx. Glumes much shorter than the lemmas.
     · Tall sea-shore plant with pungent leaves . . 21. *Halopyrum*
     ·· Not so . . . . 19. *Eragrostis*
   oo. Ligule scarious.
    x. Panicle soft with capillary pedicels . . . . 31. *Poa*
    xx. Panicle stiff with thick pedicels . . . . . 10. *Cutandia*

1. *AELUROPUS TRIN.*

Perennial grasses with string-like, creeping stem producing sterile leaf-shoots and numerous clustered short culms from the nodes. Leaves convolute, on young shoots 2-ranked. Spikelets with 4–18 bisexual florets arranged in a dense, capitate or spiciform unilateral panicle.

Aeluropus: from the Greek *ailouros*, cat, and *pous*, foot.

1. *Aeluropus lagopoides* *(L.) Trin. ex Thwaites*, Enum. Pl. Zeyl. 374 (1864), as *lagopodioides sphalm*; Täckh. et Drar, Fl. Egypt 1: 197 (1941); Bor, Fl. Iraq 9: 423 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 694, t. 256 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 781 (1978).

Dactylis lagopoides L., Mant. Plant. 1: 33 (1767). *D. repens* Desf., Fl. Atlant. 1: 79 (1798). *Aeluropus villosus* Trin. ex. C. A. Mey., Verz. Pfl. Cauc. 18 (1831). *A. littoralis* var. *repens* (Desf.) Coss. et Dur., Expl. Sc. Alg. 2: 155 (1855); Boiss., Fl. Orient. 5: 594 (1884). *A. repens* (Desf.) Parl., Fl. Ital. 1: 462 (1848); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 756 (1933).

A perennial grass, with densely tufted culms or sending up spaced erect shoots from long, prostrate stems. Stolons and/or rhizomes present, the latter covered with hairy overlapping scales; culms up to 15 cm tall. Leaf-blades lanceolate or less pungent; ligules a rim of hairs. Inflorescence a dense globular or oblong head up to 1·5 cm long, 1-sided.

A very common plant of the littoral salt marshes of Qatar. The plant is known locally as *Ikrish*: a name also used in Arabia. It flowers in the summer (Plate 110).

2. *ARISTIDA L.*

Perennial or annual grasses. Leaf-blades narrow, often convolute. Inflorescence a panicle of pedicelled awned spikelets. Spikelets 1-flowered, hermaphrodite, glumes persistent; lemma with a trifid awn. Awns with glabrous branches.

Aristida from the Greek *aristos*, bristle, awn.

+ Panicle open, 10 cm long, middle awn 15–20 mm long . . 1. *A. abnormis*
++ Panicle contracted, 5–7 cm long, middle awn up to 25 mm long 2. *A. meccana*

1. *Aristida abnormis* *Chiov.*, Ann. Inst. Bot. Roma 8: 48 (1903); Bor in Rech., Fl. Iran. 70: 366 (1970); Boulos, Webbia 32: 383 (1978).

Annual grass with dense caespitose culms, 20 cm high. Leaves glabrous, erect or the basal ascendent, 4–6 cm long, 0·5–1 mm broad. Panicle open, about 10 cm long, 2–3 cm broad. Glumes 8–10 mm long, 3-nerved. Lemma 15–20 mm long. Awns 3, the middle 15–20 mm long, lateral shorter.

Occasional in Qatar; in rocky habitats. Flowering from February to April.

1. *Aristida meccana* *Hochst.* ex Trin. et Rupr. in Mém. Acad. Péters., Ser. VI 7: 152 (1849); Täckh., Stud. Fl. Egypt, ed. 2, 728 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 737 (1978). *A. schweinfurthii* Boiss., Fl. Orient. 5: 493 (1884).

Tufted annual grass. Culms glabrous, erect, branching from the base. Leaves curved, convolute, sheaths glabrous, bearded at ligule. Panicle dense, contracted, only 5–7 cm

long, with branches mostly 2 cm long, not or little naked below. Glumes much unequal; awns up to 25 mm long.

Rare in Qatar. Flowering from February to April.

3. *ARUNDO L.*

Tall, stout, perenial grasses with hallow culms and flat, broad leaf-blades. Inflorescence a large plume-like panicle with the lower branches fascicled. Spikelets laterally compressed, few-flowered. Glumes about equal, lemmas 2-fid with a short awn in the sinus, covered all over the back below the middle with long, soft hairs; palea shorter, 2-keeled.

1. ***Arundo donax*** *L.*, Sp. Plant., ed. 1, 81 (1753); Boss., Fl. Orient. 5: 564 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 745 (1933); Täckh. et Drar, Fl. Egypt 1: 203 (1941); Bor, Fl. Iraq 9: 372, t. 142 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 696 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 754 (1978).

A perennial with woody rhizome swollen here and there. Culms stout, erect, up to over 4 m in height. Leaves conspicuously 2-ranked, 3–5 cm broad, up to 60 cm long, at base with brown auricles, at tip tapering into a long tip. Inflorescence a plume-like panicle much branched, up to 70 cm long. Lemma 3-nerved, 2-fid, with a short awn in the sinus, covered all over the back below the middle with long, soft hairs.

Rare in Qatar; recorded once in a moist habitat in a cultivated land at Al-Wabrah. Non-flowering material.

4. *ASTHENATHERUM NEVSKI*

Perennial, densely leafy desert grasses with woolly root fibres. Ligule a rim of hairs. Panicle dense, narrow, of large 3-flowered spikelets, enclosed at the base in the uppermost leaf sheaths. Glumes subequal, acute, strongly nerved, including the lemmas. Lemma small, hairy on the back, cleft at the apex into 2 acuminate lobes, awned in the sinus. Awns straight, not exerted from the spikelet.

Asthenatherum: from the Greek *astheneia*, weakness, and *asther*, awn—that is, short-awned.

1. ***Asthenatherum forsskalii*** *(Vahl) Nevski* in Act. Univ. As. Med. Ser. 8b, Bot. Fasc. 17: 8 (1934); Täckh. et Drar, Fl. Egypt 1: 331 (1941); Bor, Fl. Iraq 9: 382, t. 145 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 713 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 751 (1978).

Avena forsskalii Vahl, Symb. Bot. 2: 25 (1791).

Danthonia forsskalii (Vahl) R. Br. in Denh. et Clapp., Narr. Trav. Nort. & Centr. Africa, App. 244 (1826); Boiss., Fl. Orient. 5: 551 (1884); Post, Fl. Syria Pal. et Sinai, ed. 2, 2: 740 (1933).

A loosely tufted perennial with erect or shortly decumbent, woolly culms and very thick, sand-covered roots. Leaf-blades glaucus, linear, pungent, usually hairy on both surfaces; sheaths lax, often scarious below, covered with silky hairs. Panicle dense, narrow, partly enclosed in the spathe-like uppermost leaf-sheath. Spikelets 7–8 mm long, 2–3-flowered, crowded, pale yellow or tinged with purple. Glumes subequal. Lemmas with tufts of hair between the nerves, bifid at apex, with 4–5 mm awn in the sinus.

Rare desert grass in sandy habitats in southern Qatar. Flowering in the summer.

5. *AVENA L.*

Annuals with flat leaf-blades. Inflorescence an open panicle of pedicelled, pendulous, large, 2–4-flowered spikelets. Glumes subequal, membranous, several-nerved, exceeding the indurated lemmas. Lemmas have stout, keeled, below twisted awns on their back.

1. *Avena sterilis* *L.*, Sp. Plant., ed. 2: 118 (1762); Boiss., Fl. Orient. 5: 542 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 737 (1933); Täckh. et Drar, Fl. Egypt 1: 329 (1941); Bor, Fl. Iraq 9: 340 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 713 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 754 (1978).

A coarse grass with stout, solitary or fasciculate culms reaching a height of 1 m. Panicle 1-sided with large, 3–4-flowered spikelets, mostly 2-awned. Flowers falling as a unit, not one by one. Lemma hairs varying from cream to brown or black.

A common weed in cultivated *rodat* and gardens. Flowering from March to April.

6. *BROMUS L.*

Annual (our species) grasses with closed leaf sheaths and flat leaf-blades. Inflorescence a panicle, contracted and erect or effuse and nodding. Spikelets (wedge-shaped or lanceolate in outline) several-flowered with the rachilla disarticulating above the glumes. Glumes unequal, awnless, shorter than the spikelet. Lemmas 2-toothed, awned from between the teeth.

1. Spikelets lanceolate, tapering towards the tips, panicle branches short.
   a. Lemmas, at least upper ones, 3-awned, awns recurved at maturity, side lemmas shorter . . . . 1. *B. danthoniae*
   b. Lemmas with only 1 awn . . . . 3. *B. scoparius*
2. Spikelets wedge-shaped, panicle branches 1–3 cm long, unequal . . 2. *B. madritensis*

1. *Bromus danthoniae* *Trin.* in C. A. Mey., Verz. Pfl. Cauc. 244 (1831); Bor, Fl. Iraq 9: 136, t. 47 (1968).

B. macrostachys Desf. var. *triaristatus* Hack. in Flora 62: 155 (1879); Boiss., Fl. Orient. 5: 652 (1884).

B. macrostachys Desf. ssp. *danthoniae* (Trin.) Asch. et Graebn., Syn. Mitteleur. Fl. 2, 1: 627 (1901).

B. lanceolatus Roth. var. *danthoniae* (Trin.) Dinsm., Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 775 (1933).

Annual grass with geniculately ascending, fascicled culms. Inflorescence of solitary spikelets, often with the spikelets racemosely arranged on rather short pedicels. Spikelets lanceolate, 1–5 cm long, somewhat laterally compressed. Lemmas (at least the upper) with 3 awns. Awns recurved at maturity. Side awns shorter or frequently missing in the lower lemmas. Awns often coloured purplish or reddish-purple.

Rare in Qatar; recorded at Al Sadd in Doha. Flowering in March.

2. *Bromus madritensis* *L.*, Cent. Pl. 1: 5 (1755); Amoen. Acad. 4: 265 (1759); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 772 (1933); Täckh. et Drar, Fl. Egypt 1: 160 (1941); Bor, Fl. Iraq 9:

148 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 681 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 753 (1978).

Annual grass with fascicled, erect or ascending culms. Panicle interrupted, erect or slightly nodding. Spikelets green or purple, including awns 3·5–6 cm, wedge-shaped, in twos or threes upon the branches which are 1–3 cm long. Lemma 12–19 mm long, 3 mm wide with hyaline teeth at the tip up to 2–3 mm long.

In dry specimens, panicle is fan-shaped.

Rare in Qatar, recorded at Umm Slal Mohammed along the road from Doha. On stony ground (Plate 110).

Flowering in April.

3. ***Bromus scoparius*** *L.*, Cent. Pl. 1: 6 (1755); Ameon. Acad. 4: 266 (1759); Boiss., Fl. Orient. 5: 650 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 773 (1933); Täckh et Drar, Fl. Egypt 1: 150 (1941); Bor, Fl. Iraq 9: 152, t. 51 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 678 (1974).

Annual, with glabrous culms and pubescent leaf-sheaths, 15–50 cm high. Panicle compact, oblong–obovate in outline, 3–5 cm long. Spikelets lanceolate, pedicels rarely over 2 mm long. Lemma very shortly bifid at the apex, awned with a recurved awn below the tip.

Var. ***psilostachys*** *Halacesy*, Consp. Fl. Graec. 3: 399 (1901); Täckh., Stud. Fl. Egypt, ed. 2: 678 (1974). Spikelets glabrous.

The variety is recorded along the road from Doha to northern Qatar, near Umm Slal Mohammed; the type is not recorded. Bor, in Fl. Iraq 3: 154 (1968), claims var. *scoparius* would presumably replace the varietal name *psiloctachys* Hal.

On rocky ground where fine shallow sediments accumulate. Flowering from April to May.

7. *CENCHRUS L.*

Usually low, branching annual or perennial grasses. Leaf-blades flat and ligules are replaced by a rim of hairs. Inflorescence a solitary spike-like panicle. Spikelets sessile, awnless, solitary or in clusters of 2–7, in an involucre and falling with it at maturity. Involucre of more or less fused bristles or spines arising from a broad, disc-shaped base and forming together with the spikelets a 'bur'. Spikelets 2-flowered, the lower male or barren, the upper hermaphrodite.

1. Bristles connate at the base only . . . . 1. *C. ciliaris*
2. At least the inner bristles connate above the base for 1–3 mm 2. *C. pennisetiformis*

1. ***Cenchrus ciliaris*** *L.*, Mant. Pl. 302 (1771); Täckh. et Drar, Fl. Egypt 1: 476 (1941); Bor, Fl. Iraq 9: 474, t. 182 (1968).

Pennisetum ciliare (L.) Link, Hort. Berol. 1: 213 (1827); Boiss., Fl. Orient. 5: 445 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 701 (1933).

A perennial grass with tufted culms, erect or geniculately ascending from a stout woody rootstock. Inflorescence a false spike, up to 10 cm long, pale yellow or purplish, often

flexuose. Spikelets solitary or in clusters of 2–3, enclosed by an involucre of 2 kinds of bristles, an outer circle of slender, scabrid bristles and an inner circle of longer, stouter, flattened bristles which are ciliate in the lower half, with tubercle-based hairs. One bristle 16 mm, others 12 mm.

The plant is not common in Qatar. It grows on compact soil and flourishes along the margins of irrigated *rodat*. Flowering mainly in the spring, also in other seasons (Plate 111).

2. *Cenchrus pennisetiformis* *Hochst. et Steud.* Nom., Bot. ed. 2 (1): 217 (1840); Täckh. et Drar, Fl. Egypt 1: 477 (1941).

Annual grass of variable aspect, from a few up to 50 cm. Spike long and dense or short and lax. Bristles white, green or dark purple, the outer ones awn-like, inner ones thickened or flat and connate into a small cup at the base, upwards usually awn-like and plumose hairy.

The plant is rare in Qatar and is recorded in the marginal land of irrigated *rodat*. Flowering from February to April (Plate 111).

8. *CHLORIS SWARTZ*

Annual or perennial grasses with erect culms. Inflorescence a panicle of 3 or more digitate, silky-villous spikes. Spikelets all alike, 2–4-flowered, sessile, laterally compressed, awned. Glumes persistent as small hyaline scales on the rachis after lemmas has fallen. Lower floret hermaphrodite, others (1 or several) reduced, often truncate and forming a club-shaped rudiment. Fertile lemma with a fine awn or mucro, sterile ones awned or awnless.

1. *Chloris virgata* *Swartz*, Fl. Ind. Occ. 1: 203 (1797); Täckh. et Drar, Fl. Egypt 1: 385 (1941); Bor, Fl. Iraq 9: 450, t. 172 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 732 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 716 (1978).

C. meccana Hochst. et Steud., Syn. Pl. Glum. 1: 205 (1854); Boiss., Fl. Orient. 5: 554 (1884). *C. barbata* var. *meccana* Asch. et Schweinf. (1887). *C. virgata* vars. *elegans* Stapf (1898–1900).

Annual grass, decumbent and rooting at the base finally erect, branches reaching a height of 50 cm, smooth and glabrous even at the nodes. Leaf-blades up to 15 cm long, flat, rather rough on the margins, hairy towards the base; sheaths somewhat inflated, smooth and glabrous. Inflorescence of 4–9 spikes, digitately arranged, ascending, not widely spreading, up to 6 cm long, sometimes enclosed in the inflated uppermost leaf-sheath. Spikelets closely packed in 2 rows and secured along the rachis of the spike, 3–4 mm long, with 2 awns. Spikes soft, silky, due to the spikelets having a terminal hair tuft from the upper margin of the lemma. Sterile floret small, glabrous, awned.

Very common weed in Qatar, on cultivated irrigated land; along irrigation canals and moist waste places. Flowering from April to October (Plate 112).

9. *CHRYSOPOGON TRIN.*

Perennial grasses with narrow leaf-blades. Inflorescence a terminal open, naked panicle.

Spikelets dorsally compressed in clusters of threes, 1 sessile and 2 pedicelled, the 3 falling united like a true spikelet. Spikelets 2-flowered, the lower floret reduced to an empty lemma, the upper hermaphrodite in the sessile, male in the pedicelled spikets. Upper glumes of the sessile flowers awned while lower glumes of the pedicelled flowers are awned or without awns. Upper lemmas have glabrous awns.

Chrysopogon from the Greek *Chrysos*, golden, and *pogon*, beard—a reference to the golden-brown awns or callus-hairs of many species.

1. Pedicels of the pedicelled spikelets half the length of the sessile spikelet or longer . . . . 2. *C. gryllus*
2. Pedicels of the pedicelled spikelets shorter than half the length of the sessile spikelet . . . . 1. *C. aucheri*

1. *Chrysopogon aucheri* *(Boiss.) Stapf* in Kew Bull. 1907: 211 (1907); Täckh. et Drar, Fl. Egypt 1: 519 (1941); Bor, Fl. Iraq 9: 514 (1968).
Andropogon aucheri Boiss., Diagn. Ser. 1, 5: 77 (1744).

The variety *quinqueplumis* (A. Rich) Stapf (1917) is the representative of this species in Qatar.

A glaucus perennial with branched, slender culms, woody at base. Leaves short crowded at base. Panicle 5–10 cm long of capillary whorled branches, bearded at tip. The pedicels of the pedicelled spikelets are less than half the length of the sessile spikelets. The upper glume of the sessile spikelet and both the glumes of the 2 pedicelled spikelets running out into plumose awns, hence its varietal name '*quinqueplumis*' denoting 5 plumes.

The plant is common in Qatar. It grows in rocky habitats, e.g. the *hozoom* and the narrow runnels with rocky beds crossing the slopes of the *hozoom*.

The plant is known in Qatar by the name *Haltaa*; it flowers mainly from April to June (Plate 123).

2. *Chrysopogon gryllus* *(L.) Trin.*, Fund. Agrost., 188 (1820); Boiss., Fl. Orient. 5: 458 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 706 (1933); Bor, Fl. Iraq 9: 512, t, 196 (1968).
Andropogon gryllus L., Cent. Pl. 2: 33 (1756).

A perennial grass, up to 90 cm tall. Culms simple, tufted, erect from a very stout rootstock. Inflorescence an open panicle, 10–20 cm long. Spikelets terminate verticillate, glabrous branches. Spikelets in threes (1 sessile and 2 pedicelled). Sessile spikelets with a stout awn twisted at the base. The pedicels of the pedicelled spikelets are half the length of the sessile spikelet or longer.

The plant is not common in Qatar. It grows on the dry rocky ground on the *hozoom* slopes and narrow runnels crossing them. The local name is *Haltaa*; the same name as *C. aucheri*. Flowering from April to June.

10. *CUTANDIA WILLK.*

Annual, much-branched grasses. Leaf-blades much narrower than the sheaths. Panicles numerous, dichotomously branched, with short divericate branches. Spikelets 3–8-flowered, laterally compressed, hermaphrodite, in the ultimate dichotomy.

Cutandia, in honour of Dr Vicente Cutande, at one time Professor of Botany and Keeper of the herbarium at the Royal Botanic Gardens, Madrid.

1. ***Cutandia memphitica*** *(Spreng.) Benth.* in Journ. Linn. Soc. Bot. 19: 118 (1881); Täckh. et Drar, Fl. Egypt 1: 169 (1941); Bor, Fl. Iraq 9: 70, t. 24 (1968).

Dactylis memphetica Spreng. in Bot. Gard. Halle Nachtr. 1: 20 (1801). *Scleropoa memphetica* (Spreng.) Parl., Fl. Ital. 1: 471 (1848); Boiss., Fl. Orient. 5: 639 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 769 (1933).

An annual grass with many fascicled purple-noded culms. Leaf-blades narrower than sheaths. Inflorescence a dichotomously divided panicle in which each branch divides into a short-pedicelled spikelet and a short branch which continues division in the same way, partly included in the uppermost leaf-sheath; in the angle of each division there are 2 cushion-shaped bodies of glandular tissue, purple in colour. Lemmas ending in an awn-like mucro; spikelets up to 8 mm long.

The plant is rare in Qatar. It grows in sandy habitats and on sand hills, especially in southern Qatar. Flowering from March to April.

11. *CYMBOPOGON SPRENG.*

Perennial aromatic grasses. Racemes short, in pairs, each pair surrounded by a spathaceous sheath, the pairs together forming a rich, compound, spathaceous panicle. Pairs of spikelets, 1 sessile and 1 pedicelled, seated at each joint of the rachis of the racemes, the lower 1–2 pairs male or empty. Spikelets 2-flowered, the lower male or neuter, the upper hermaphrodite in the sessile, male or neuter in the pedicelled spikelet. Awn glabrous from the sinus of the bifid lemma.

Cymbopogon from the Greek *Kumbe*, a hollow vessel, cup or boat, *pogon*, beard, referring to the conspicuous boat-shaped spatheoles of the many-awned inflorescence.

1. ***Cymbopogon parkeri*** *Stapf.* Kew Bull. 1929: 10 (1929); Bor in Rech., Fl. Lowland Iraq 38 (1964) et Fl. Iraq 9: 518 (1968).

A perennial aromatic plant smelling strongly of lemon, densely tufted grass, with woolly or sparsely hairy basal leaf-sheaths. Leaf blades narrow, almost filiform. Panicle erect, spatheate, up to 40 cm long. Racemes 2, diverícate; lowest joint of the sessile raceme adnate to the lowest pedicel, and both swollen, hard.

The plant is very common, particularly in central and northern Qatar. It dominates a community which abounds in shallow depressions receiving runoff water and water-borne fine sediments. The plant flourishes in spring and flowers from March to June. It is grazed by sheep.

The local name is *Skhabar*, a name of widespread use for other species of *Cymbopogon* in other Arab countries (Plates 112, 113).

12. *CYNODON L. R. RICH.*

Perennial grasses with creeping stolons and/or rhizomes and short narrow leaf-blades. Inflorescence a collection of spikes digitately arranged at the tip of the culms. Spikelets awnless, 1-flowered in 1–2 mm broad spikes.

1. ***Cynodon dactylon*** *(L.) Pers.*, Syn. Pl. 1: 85 (1805); Boiss., Fl. Orient. 5: 553 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 740 (1933); Täckh. et Drar, Fl. Egypt, 1: 378 (1941); Bor, Fl. Iraq, 9: 454, t. 174 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 732, t. 268 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 707 (1978).
Panicum dactylon L., Sp. Plant., ed. 1, 58 (1753).

Perennial with extensively creeping rhizomes or stolons producing rows of leafy culms. Leafy shoots ending in a cluster of digitate spikes (4–5), often purplish, 2–5 cm long. Spikelets imbricated in 2 rows along one side of the slender rachis.

Var. ***dactylon.***
Racemes more or less glabrous.
Var. ***villosus*** *Regel*, in Bull. Soc. Imp. Nat. Mosc. 41: 305 (1868).
Racemes densely villous.

It is a common weed in Qatar. Var. *dactylon* occurs in gardens and cultivated *rodat*, while var. *villosus* has been reported along the road from Doha to Shamal, it is less common than var. *dactylon*. The plant is commonly used for lawns at Doha.
The local name for this plant is *Thaiyil*, or *Najil* or *Najm*.
Flowers more or less throughout the year.

13. *DACTYLOCTENIUM WILLD.*

Annual or perennial grasses with flat leaf-blades. Inflorescence an umbel of digitate spikes. Spikes terminated by the naked tip of the rachis. Lemmas similar to the upper glume, awned or mucronate, awn or mucro curved.
Dactylactenium: from the Greek *dactylos*, finger, *ktenion*, a little comb—from the comb-like arrangement of the spikelets.

1. ***Dactyloctenium aegyptium*** *(L.) P. Beauv.*, Ess. Agrost., Expl. Pl. 15 (1812); Boiss., Fl. Orient. 5: 556 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 741 (1933); Täckh. et Drar, Fl. Egypt, 1: 392 (1941); Bor, Fl. Iraq 9: 426, t. 161 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 734, t. 269 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 717 (1978).
Cynosurus aegyptius L., Sp. Plant., ed. 1: 72 (1753).

Annual with compressed culms, richly branching, ascending, rooting at the nodes. Leaf-blades linear-acuminate, ciliate on the margins with bulbous-based hairs. Spikes 2–6, digitately spreading, 2–3 cm long, *ca.* 5 mm broad. Spikelets 3–4-flowered, compressed, closely imbricated in 2 rows along one side of the flat rachis. Rachis of the spike terminated by a naked tip.
A very common weed in shady places, along irrigation channels, in date groves. Sometimes called *Najm* by the natives due to the digitate inflorescence. Flowering from May to October (Plate 114).

14. *DICHANTHIUM WILLEMET.*

Annual or perennial grasses with flat leaf-blades. Inflorescence of 3–9 subdigitate, spike-like racemes consisting of jointed, fragile axes, at the articulations of which the

spikelets are situated in pairs, a sessile accompanied by a pedicelled. Florets 2, the lower neuter, the upper hermaphrodite in the sessile spikelets, both or 1 male, or both neuter in the pedicelled spikelets, those of the 2–4 lowest pairs neuter. Fertile lemma terminated by a glabrous awn.

Dichanthium: from the Greek *dicha*, in two, and *anthos*, flower—an allusion to the two kinds of spikelet, hermaphrodite and male or neuter, which are collected in different parts of the inflorescence.

1. *Dichanthium annulatum* *(Forssk.) Stapf* in Prain, Fl. Trop. Afr. 9: 178 (1917); Täckh. et Drar, Fl. Egypt 1: 515 (1941); Bor, Fl. Iraq 9: 523, t. 200 (1968), Täckh., Stud. Fl. Egypt, ed. 2, 760, t. 280 (1974).

Andropogon annulatum Forssk., Fl. Aegypt.-Arab. 173 (1775); Boiss., Fl. Orient. 5: 463 (1884).

A perennial, with a thick woody rhizome; culms densely tufted, attaining 1 m in height, with bearded nodes. Inflorescence of 3–9 spike-like, subdigitate racemes, purplish in colour, consisting of numerous overlapping, sessile and pedicelled spikelets. Sessile spikelets awned; awns kneed.

A common grass in Qatar growing along irrigation channels, damp fields and waste moist places in *rodat*. Flowering from March to October (Plate 115).

15. *DIGITARIA* *HEIST EX FABR.*

Annual (ours) or perennial grasses with narrow, flat leaf-blades and erect culms mostly decumbent at the base. Inflorescence in our species of racemes digitately arranged. Spikelets small, awnless, nearly plane–convex, subsessile or short-pedicelled, alternate in 2 rows along one side of a rachis thus forming 1–2 mm broad, spike-like racemes, glumes unequal.

Digitaria, from the Latin *digitus*, finger, an allusion to the radiating spikes.

1. *Digitaria sanguinalis* *(L) Scop.*, Fl. Carn., ed. 2, 1: 52 (1772); Täckh. et Drar, Fl. Egypt 1: 425 (1941); Bor, Fl. Iraq 9: 478 (1968) et Fl. Iran. 70: 491 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 742 (1974); Migahid, Fl. Saudi Arab., ed. 2, 718 (1978).

Panicum sangiunale L., Sp. Plant., ed. 1, 57 (1753); Boiss., Fl. Orient. 5: 433 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 695 (1933).

Annual grass, branching from the base and often rooting at the base. Leaf-blades linear–acuminate; sheaths covered below with a dense, hirsute covering of tubercle-based hairs. Spikes 5–15 cm long, spikelets 3 mm long, pubescent along the margins. Nerves of lower lemma with glossy scabridities near the tip.

Rare in Qatar; on ditches and channels in gardens. Recorded only at Al-Wabrah. Flowering from August to December (Plate 115).

16. *DIPLACHNE* *P. BEAUV.*

Perennial or annual grasses. Panicle consisting of simple branches, covered from base to tip by subsessile, many-flowered, awnless spikelets. Glumes unequal, much shorter than

the spikelet. Lemma with a prominant mid-nerve produced as a mucro between the 2 teeth at the tip.

1. ***Diplachne fusca** (L.) P. Beauv.*, Ess. Agrost. 163 (1812); Boiss., Fl. Orient. 5: 561 (1884): Bor, Fl. Iraq 9: 434, t. 164 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 730, t. 267 (1974).

Festuca fusca L., Syst. Veg., ed. 10, 876 (1759) et Sp. Plant. ed. 2, 109 (1762). *D. reptatrix* (L.) Druce, Brit. Pl. List, ed. 2, 129 (1928); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 744 (1933).

A tall glabrous perennial, 1–1·5 m (our specimens 60–80 cm), with long leaves (up to 20 cm) and branched culms. Panicle 15–30 cm long. Spikelets 6–10 mm long, 5–10-flowered. Glumes unequal. Lemmas bidentate, with a short mucro from the cleft.

Rare in Qatar; reported only in a regularly irrigated lawn of Ramada Hotel at Doha. It grows in moist places. This species has been recorded by the author at Al-Hasa, Eastern Province, Saudi Arabia in moist habitats. Flowering from May to November.

17. *ECHINOCHLOA P. BEAUV.*

Annual (in Qatar) or perennial grasses. Panicle made up of racemes of spikelets in false spikes. Spikelets sessile or pedicelled, closely packed, usually awned or cuspidate, rounded at the back, flat on the ventral surface, 2-flowered. Glumes unequal, membranous, the lower much smaller, mucronate, the upper as long as the spikelet, mucronate or short-awned, lower lemma enclosing a male flower or barren, similar to the upper glume, awned.

Echinochloa: from the Greek *echinos*, hedgehog, and *chloa*, grass, referring to the spiny inflorescence of some species.

1. ***Echinochloa colonum** (L.) Link.*, Hort. Berol. 2: 209 (1833); Täckh. et Drar, Fl. Egypt 1: 446 (1941); Bor, Fl. Iraq 9: 479, t. 184 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 749 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 718 (1978).

Panicum colonum L., Syst. Nat., ed. 10, 2: 870 (1759); Boiss., Fl. Orient. 5: 435 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 696 (1933).

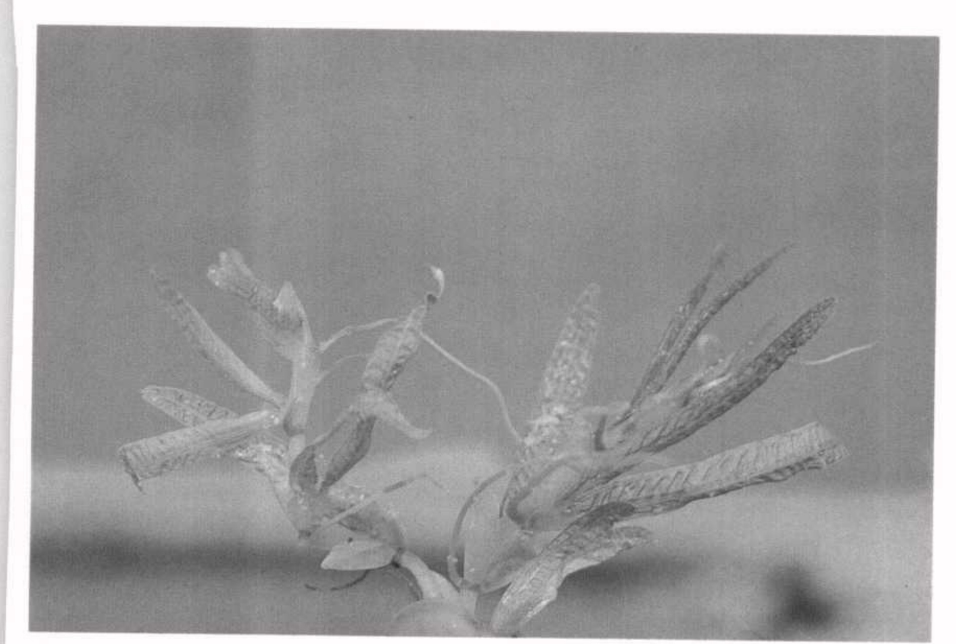
Annual with several culms 20–40 cm tall, decumbent and rooting at the base, often rooting at the basal nodes. Leaf-blades 3–6 mm broad, glabrous; ligule absent. Panicle (false-spike) terminal, 5–10 cm long, composed of simple, alternate, or nearly opposite, oblong spikes 1–2 cm long; axis of panicle at the insertion of lower spikes sometimes hairy. Spikelets in 4 rows on a rough axis, 3 mm long, almost sessile, awnless.

A very common weed in fields, gardens, on channel banks, in moist places. Flowering from May to August (Plate 115).

18. *ELEUSINE GAERTN.*

Perennial (our species) on annual grasses. Spikes digitate, with sometimes 1 or 2 spikes at a short distance below, terminated by spikelets. Spikelets 3–6-flowered, awnless, 2-ranked, in one-sided spikes.

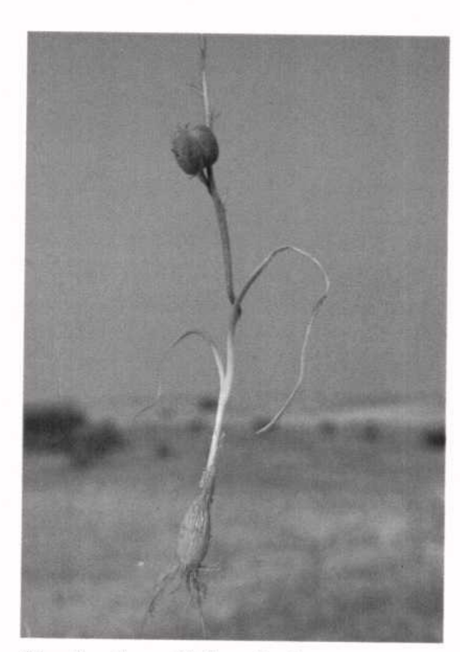
1. ***Eleusine compressa** (Forssk.) Asch. et Schweinf.* ex Christens, Dansk Bot. Archiv. 4



Halophila stipulacea (Forssk.) Aschers.



Asphodelus fistulosus L.



Dipcadi erythreum Webb. et Berth.



Aeloropus lagopoides (L.) Trin. ex Thwaites.



Bromus madritensis L.

PLATE 110



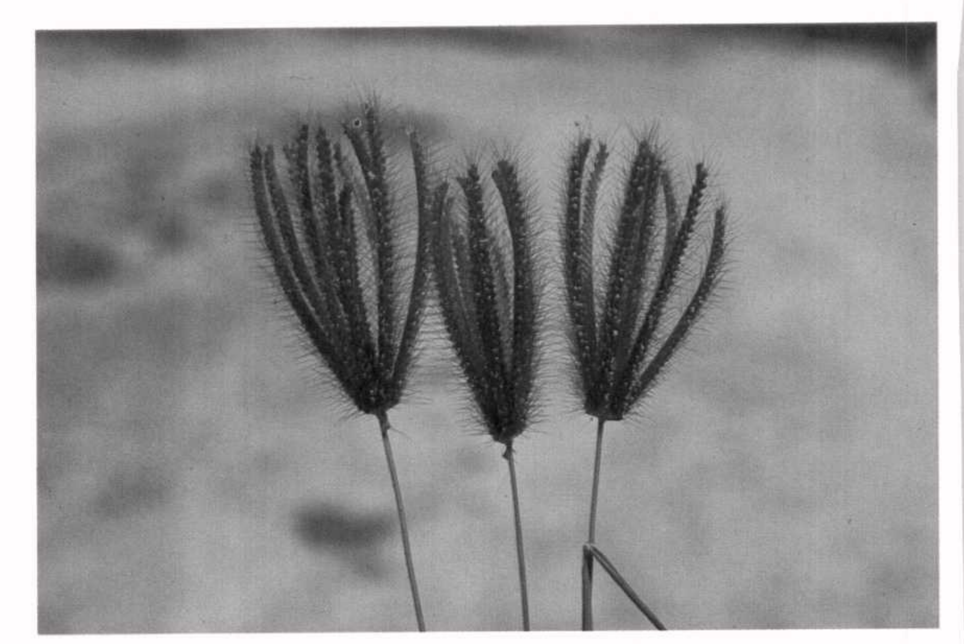
Cenchrus ciliaris L.



Cenchrus pennisetiformis Hochst et Steud.



Eremopogon foveolatus (Del.) Stapf.



Chloris virgata Swartz.



Cymbopogon parkeri Stapf.



Cymbopogon parkeri Stapf.

PLATE 112

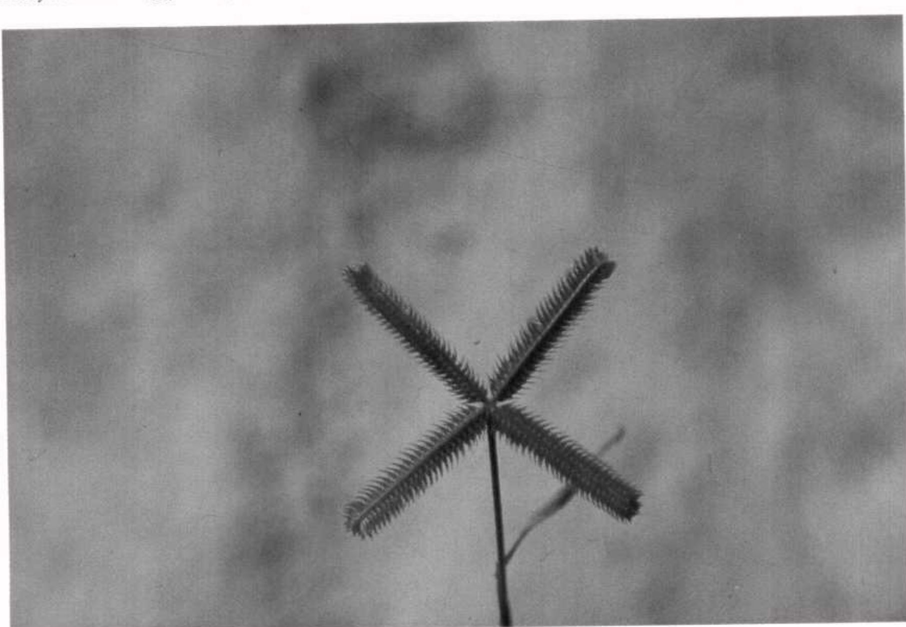


Cymbopogon parkeri Stapf.

PLATE 113

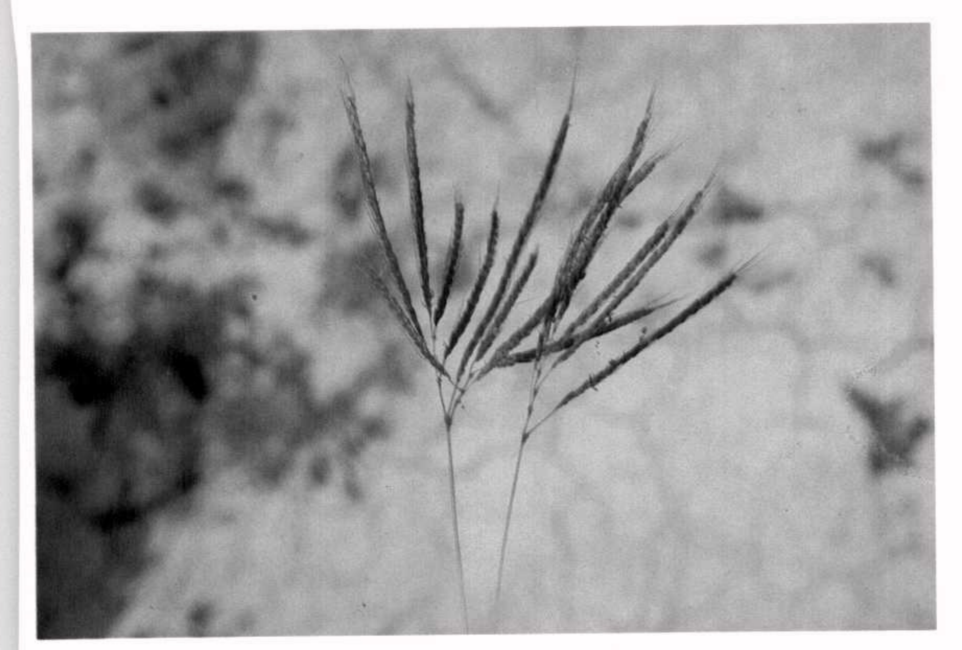


Dactyloctenium aegyptium (L.) P. Beauv.



Dactyloctenium aegyptium (L.) P. Beauv.

PLATE 114



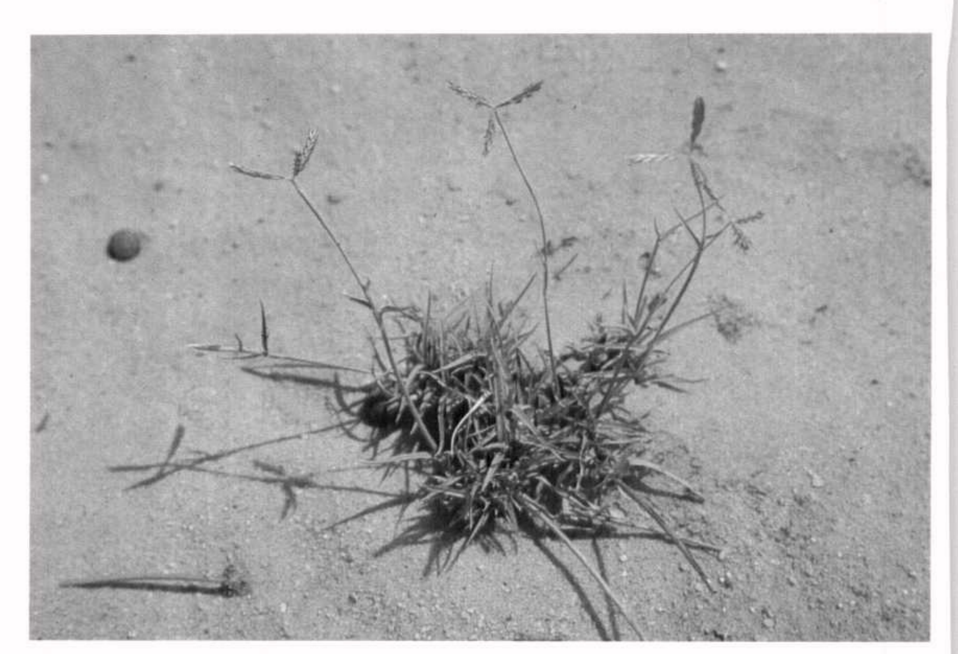
Dicanthium annulatum (Forssk.) Stapf.



Digitaria sanguinalis (L.) Scop.



Echinochloa colonum (L.) Link.



Eleusine compressa (Forssk.) Ascher. et Schweinf.



Eleusine compressa (Forssk.) Ascher. et Schweinf.

(3): 12 (1922); Täckh. et Drar, Fl. Egypt 1: 389 (1941); Bor, Fl. Iran. 70: 437 (1970); Täckh, Stud. Fl. Egypt, ed. 2, 734 (1974).

E. flagellifera Nees Linnaea 16: 220 (1842).

Stiff perennial with creeping wiry stolon-like stems, much branched and rooting at the nodes, which are often leafy and thickened. Leaves long-acuminate, often ciliated at base with long, scattered hairs along the margins. Spikes about 2–3 cm long. Spikelets much compressed, closely imbricate. Glumes and lemmas thin, apex blunt or notched, often mucronate, keeled scabrous-ciliated.

The plant is common, especially in southern Qatar. It grows in sandy depressions. Flowering mainly in March and April. It is a fairly good fodder for animals (Plate 116).

19. *ERAGROSTIS* *P. BEAUV.*

Annual (our species) or perennial with narrow, linear leaf-blades. Inflorescence open or contracted, loose panicle or spike-like. Spikelets many-flowered awnless, with persistent rachilla.

Eragrostis: from *Eros*, the Greek god of love, and *agrostis*, the Greek name for a grass: 'love grass', said to be an allusion to the graceful dancing spikelets.

A. Spikelets ciliated with a fringe of hairs from the keeled margins of the pealeas. Inflorescence contracted spike-like . . . . 3. *E. ciliaris*
B. Spikelets not ciliated.
  1. Pedicels shorter than spikelets.
    a. Spikelets 2–4 mm wide, pedicels of spikelets without gland . 2. *E. cilianensis*
    b. Spikelets 1–2 mm wide, pedicels of spikelets with a gland . 1. *E. barrelieri*
  2. Pedicels longer than spikelets, spikelets less than 2 mm wide . 4. *E. pilosa*

1. *Eragrostis barrelieri* *Daveau*. in Morot, Journ. de Bot. 8: 289 (1894); Täckh. et Drar, Fl. Egypt 1: 190 (1941); Bor., Fl. Iraq 9: 438 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 691 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 79 (1978).

Annual, densely tufted grass, with linear-acuminate leaf-blades up to 10 cm long. Panicles terminal but in addition axillary panicles arise from the lower and basal nodes, narrow, with stiff, few-flowered branches. Pedicels of the spikelets bear a crateriform gland. Spikelets 10–15 mm long, 1–2 mm broad, 12–15-flowered or more.

The plant is not common. It grows in *rodat*, especially those supporting dense growth of *Ziziphus* and have deep alluvial deposits. Flowering from April to May (Plate 117).

2. *Eragrostis cilianensis* *(All.) Vign.*-Lut. in Malpighia 18: 386 (1904); Täckh. et Drar, Fl. Egypt 1: 188 (1941); Bor, Fl. Iraq 9: 440, t. 167 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 691 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 780 (1978).

Poa cilianensis All., Fl. Ped. 2: 246 (1785). *Eragrostis megastachya* (Koel.) Link, Hert. Berol. 1: 187 (1827); Boiss., Fl. Orient. 5: 580 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 751 (1933). *E. major* (L.) Host, Grem. Austr. 4: 14, t. 24 (1809).

An annual grass with fasciculate, erect or shortly decumbent, simple or branched culms up to 60 cm tall, smooth and glabrous, with a ring of glands below the nodes. Leaf-blades linear–lanceolate, up to 15 cm long, glandular on the margins and midrib. Inflorescence a

very dense, usually steel-grey panicle, up to 15 cm long, 4 cm broad, of crowded spikelets. Spikelets larger, turgid, 15–20- (–40-) flowered, very short pedicelled.

Weed in gardens, lawns and in moist *rodat*. Flowering from April to May. The plant has a disagreeable odour when fresh, hence the name 'stink grass' (Plate 117).

3. *Eragrostis ciliaris* *(L.) R. Br.* in Tuckey, Narr. Exp. Congo, App. 478 (1818); Täckh. et Drar, Fl. Egypt 1: 136 (1941); Migahid, Fl. Saudi Arab., ed. 2, 2: 779 (1978).

A small tufted annual grass, 10–20 cm. Inflorescence a contracted narrow cylindrical spike-like panicle, spikelets short, flat, 5–12-flowered with obtuse lemmas and ciliated paleas, sessile or subsessile on short branches.

The species is represented in Qatar by var. ***brachystachya*** Bois., Fl. Orient. 5: 582 (1884); Täckh. et Drar, F. Egypt 1: 187 (1941). Panicle short (in our specimens 2–3 cm), dense, oblong to almost ovate. Culms short (10 cm).

Occasional in Qatar; recorded on fine deposits in the shade of *Ziziphus* and *Acacia* bushes. Flowering from February to March (Plate 117).

4. *Eragrostis pilosa* *(L.) P. Beauv.*, Ess. Agrost. 162 (1812); Boiss., Fl. Orient. 5: 581 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 751 (1933); Täckh. et Drar, Fl. Egypt 1: 193 (1941); Bor, Fl. Iraq 9: 447, t. 171 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 692 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 779 (1978).

Poa pilosa L., Sp. Plant., ed. 1: 68 (1753).

Annual, tufted, branched grass, with numerous small purple spikelets in a rich open capillary panicle. Spikelets up to 5 mm long, 1 mm broad, 5–11-flowered. Pedicels longer than spikelets.

A rare plant; recorded only at Al-Magda, northern Qatar where water is accumulated after relatively heavy rains. The plant grows in the shade of *Ziziphus* and *Lycium* bushes. Flowering from April to May.

20. *EREMOPOGON STAPF.*

Perennial grasses with tufted erect culms. The spike-like raceme solitary, terminal, soft, with exerted long glabrous awns.

1. *Eremopogon foveolatus* *(Del.) Stapf*, Fl. Trop. Afric., 9: 183 (1917); Täckh. et Drar, Fl. Egypt, 1: 516 (1941); Täckh., Stud. Fl. Egypt, ed. 2, 760 (1974). *Andropogon foveolatus* Del., Fl. Egypt 16, t. 8, f. 2 (1812).

A richly branched perennial grass, growing in cushion-like tufts. Leaves narrow, blue-green. Culms almost capillary upwards, nodes about 3, bearded. False spike silky, 3–4 cm long, embraced by a spathaceous sheath. Awns about 2 cm long.

The plant is common in Qatar on sandy and stony ground. Flowering from February to June, also in other seasons (Plate 111).

21. *HALOPYRUM STAPF.*

A tall, perennial, pale green sea shore grass. Spike-like panicle solitary, terminal stiff. Spikelets irregularly arranged, not in ranks, many-flowered. Internodes of the rachilla bearded at the tip with long hairs up to half the length of the lemma.

1. ***Halopyrum mucronatum*** *(L.) Stapf.*, Hook. Ic. Pl. t. 2448 (1895); Bor, Fl. Iran. 70: 426 (1970).

Uniola mucronata L. Sp. Plant., ed. 2, 104 (1762).

Eragrostis mucronata Schweinf.

A tall sea shore perennial grass. Leaves narrow, convolute, strongly ribbed inside. Panicle contracted spike-like of a few stiff erect branches. Spikelets very large, up to 2 cm, awnless with usually more than 20 closely-packed flowers. Glumes persistent after lemmas have fallen.

The plant is recorded only in maritime sand along Salwa Gulf opposite Abu Samrah. It forms huge phytogenic mounds and dominates a community along the shore.

22. *HENRARDIA C. E. HUBBARD*

Annual grasses. Leaf-sheath auriculate at the mouth. Inflorescence a terminal cylindrical spike with spikelets alternate, distichous and closely appressed to the cavities in the fragile rachis. Rachilla continuous above the glumes and continued beyond the topmost floret, crowned with a vestigial floret. Glumes equal in length, placed side by side. Grain oblong, dorsally compressed, densely hairy at the apex.

1. ***Henrardia pubescens*** *(Bertol.) C. E. Hubbard* in Blumea, Suppl. 3: 19 (1946); Bor., Fl. Iraq 9: 236, t. 82 (1968).

Rottboellia pubescens Bertol., Miscell. Bot. 1: 10, t. 1, f. 3 & 4 (1842). *Lepturus pubescens* (Bertol.) Boiss., Fl. Orient. 5: 685 (1884).

A tufted annual up to 15 cm tall, with erect or geniculately ascending minutely scabrid culms, branched at the base. Leaf-blades linear-acute, up to 5 cm long, minutely hairy; sheaths retrosely pubescent, auriculate at the mouth. Spikes usually curved, rarely straight, up to 8 cm long, 2 mm thick, glumes 8–9 mm long. Grain oblong, densely hairy at the apex.

Occasional in depressions receiving considerable runoff water and water-borne material. Flowering from March to April.

23. *HORDEUM L.*

Annuals (our species) with flat leaf-blades auricled at the base. Spike dense, compressed; spikelets in triplets at each node, 1-flowered, awned. The central spikelet sessile, bisexual, the 2 lateral ones sessile (cultivated species) or pedicelled, usually imperfect (or all fertile in cultivated barley), the 3 spikelets falling together. Glumes mostly awn-like, rigid. Lemma long-awned. Lemma and palea adherent to grain.

1. Awns up to 15 cm long . . 2. *H. vulgare*
2. Awns shorter . . . . . . 1. *H. glaucum*

1. ***Hordeum glaucum*** *Steud.*, Syn. Pl. Glum. 1: 352 (1854); Bor. Fl. Iraq 9: 248 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 705 (1974).

H. stebbinsii Covas in Madrono 10: 18 (1949). *H. murinum* (non L.) Guest in Dept. Agr. Iraq Bull. 27: 46 (1933) p.p.

Annual, 10–50 cm tall. Leaf-blades linear–acuminate, up to 10 cm long, sparsely hairy or glabrous. Spike oblong, 3–7 cm long. Glumes of central spikelet and the internal glumes of the lateral spikelets ciliate on both margins. Floret of the central spikelet pedicellate.

Occasional in small depressions on calcareous ridges. Reported mainly from Umm Slal Mohammed. Flowering from March to April (Plate 120).

2. *Hordeum vulgare* L., Sp. Plant., ed. 1: 84 (1753) emend. Lam., Fl. Franc. 3: 623 (1778); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 793 (1933); Täckh. et Drar, Fl. Egypt 1: 278 (1941); Bor, Fl. Iraq 9: 254, t. 88 (1968).

H. hexastichon L., Sp. Plant., ed. 1: 85 (1753). *H. sativum* Pers., Syn. Pl. 1: 108 (1805). *H. sativum* var. *hexastichon* (L.) Richt., Pl. Eur. 1: 130 (1890).

Annual with culms up to 90 cm tall, smooth and glabrous. Leaf-blades up to 45 cm long. Spike excluding awns, 6–10 cm long, 1·5–2 cm broad, square or hexagonal in section. Spikelets all fertile; glumes linear–lanceolate, produced into a fine, scabrid awn. Lemmas broadly ovate–lanceolate, strongly 5-nerved, armed with a powerful awn up to 15 cm long and 1 mm broad at base.

Cultivated in Qatar, also escaping cultivation. In lawns at Doha, where the soil is transported from *rodat*, *H. vulgare* grows profusely. Flowering from March to April. The common name *Shair* is used throughout all the Arab countries.

24. *LASIURUS BOISS.*

Perenial grasses, often woody below, with very firm linear to convolute leaf-blades. Spike-like racemes terminal, silky hairy, with a jointed, very brittle rachis. Spikelets 2–3 at each node, 2-flowered.

Lasiurus: from the Greek *lasios* hairy, and *oura*, a tail, a description of the erect, terminal, hairy inflorescence.

1. *Lasiurus hirsutus* (*Forssk.*) *Boiss.*, Diagn. Ser. 2, 4: 146 (1859); Täckh. et Drar, Fl. Egypt 1: 480 (1941); Bor, Fl. Iraq 3: 538, t. 206 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 756 (1974).

Saccharum hirsutum Forssk., Fl. Aegypt.-Arab. 16 (1755).

Rottboellis hirsuta Vahl, Symb. Bot. 1: 11 (1790); Boiss., Fl. Orient. 5: 466 (1884). *Elyonurus hirsutus* (Vahl) Munro ex Benth. in Journ. Linn. Soc. (Bot.) 19: 68 (1881); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 711 (1933).

T. Cope (personal communication) mentions that *L. hirsutus* (Vahl) Boiss. is nom. illegit.; it must be *L. scindicus* Henr., Blumea 4: 514 (1941).

Pale yellow bushy desert grass. Culms woody below, up to 90 cm tall, simple or branched, bushy, erect from a thick woody rhizome covered with firm, imbricate, often silky cataphylls. Leaf-blades firm, ending in a filiform tip; ligule a fringe of hairs. Racemes silky, villous, 10 cm long, erect, terminal. Spikelets sessile and pedicelled. Sessile spikelets 2-flowered, the lower male, the upper hermaphrodite.

The plant is common in southern Qatar. It grows on sandy soils in large bushy thickets forming phytogenic mounds. The plant is grazed by animals. Flowering almost all the year (Plate 119).

25. *LOLIUM* L.

Annual or perennial grasses with flat leaf-blades. Inflorescence a terminal spike of spikelets, distichously and alternately arranged at the nodes in the cavities of a more or less tough axis. Spikelets sessile, flat, several-flowered. Glumes of the terminal spikelet equal and similar, the lower reduced in the lateral spikelets. Lemma awned or awnless.

1. ***Lolium rigidum*** *Gaudin.*, Agrost. Helvet. 1: 334 (1811); Boiss., Fl. Orient. 5: 680 (1884); Post, Fl. Syr., Pal et Sinai, ed. 2, 2: 790 (1933); Täckh. et Drar, Fl. Egypt 1: 305 (1941); Bor, Fl. Iraq 9: 94, t. 33 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 708 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: (1978).

Annual with many fascicled, geniculately ascending, rather stout culms, up to 80 cm tall, often branched at the base. Sterile leaf-shoots lacking. Spikelets 1–2 cm long, flattened, 4–12-flowered. Upper glumes more than half as long as the spikelet. Lemmas 5–9 mm, long, awnless or short-awned.

An occasional weed in gardens and moist habitats in *rodat*. Flowering from March to April.

26. *LOPHOCHLOA* RCHB.

Slender annual grasses with flat leaf-blades. Inflorescence a compact spike-like panicle. Spikelets 3–5-flowered, glumes unequal. Lemmas keeled, bifid at the tip, awned just below the tip with a straight awn.

1. ***Lophochloa pumila*** *(Desf.) Bor*, Grass. Burm. Ceyl. Ind. Pak. 445 (1960) et Fl. Iraq 9: 354, t. 134 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 710 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 752 (1978).

Avena pumila Desf., Fl. Atlant. 1: 103 (1798). *Koeleria pumila* (Desf.) Domin in Fedde. Rep. Sp. Nov. 2: 31 (1906), Täckh. et Drar, Fl. Egypt 1: 319 (1941). *K. sinaica* Boiss., Diagn. Ser. 1, 13: 53 (1853) et Fl. Orient. 5: 573 (1884). *Trisetum pumilum* (Desf.) Kunth, Rev. Gram. 1: 102 (1829).

Annual small grass with erect, fascicled, glabrous and smooth culms. Leaf-blades up to 6 cm long, 4 mm broad, shortly ciliate on the margins. Inflorescence a dense panicle, up to 3·5 cm long. Glumes equal, the lower densely furry, the upper less hairy, or both almost glabrous; terminal part of rachilla with long hairs. Lemma acute, glabrous. Awn well-developed, inserted just below the acute tip.

Occasional in Qatar; it grows in depressions and runnels. Flowering from March to April.

27. *PANICUM* L.

Annual or perennial grasses. Inflorescence open or contracted panicle. Spikelets pedicelled, 2-flowered, awnless, falling entire from the pedicels at maturity, with one perfect terminal floret and below this a male or empty floret and 2 glumes. Grain elliptic in outline, enclosed by the lemma and palea.

1. ***Panicum turgidum*** *Forssk.*, Fl. Aegypt.-Arab. 18 (1775); Post, Fl. Syr., Pal. et Sinai, ed.

2, 2: 698 (1933); Täckh. et Drar, Fl. Egypt 1: 435 (1941); Bor, Fl. Iraq 9: 490, t. 188 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 746 (1979).

Desert perennial grass, growing in desert bushes, up to 1 m high or more. Culms woody, densely branched with clusters of brown empty leaf-sheaths at the swollen nodes. Roots very thick, covered with a sheath of sand—thus of a corky appearance. Leaf-blades linear, ending in a sharp tip. Inflorescence a panicle with few, spreading branches carrying a small number of spikelets; spikelets 4 mm long, turgid, with almost equal glumes.

The plant is very common in Qatar, especially to the south of the country where it dominates a community occupying sandy habitats in which sand is mainly deposited by wind, e.g. in depressions and sandy accumulation.

This tufted grass is a good fodder for camels and other animals, especially in the summer when annuals disappear. The plant flourishes and produces new leaves by the end of spring and advent of summer. It flowers from April to June.

It is generally known across the breadth of Arabia and Egypt as *Thammam* (also *Tamam* or *Ithmam*) (Plate 118).

28. *PENNISETUM* *L. C. RICH.*

Annuals or perennials, with simple or branched culms and flat leaves. Inflorescence spike-like panicle consisting of awnless spikelets which are solitary or in groups of 2–5 and pedicelled, surrounded by an involucre of simple or plumose bristles, free from the very base and falling attached to the spikelet.

Pennisetum: from the Latin *penna*, feather, *seta*, bristle, referring to the long feathery bristles of the inflorescence in some species.

1. *Pennisetum divisum* *(Gmel.) Henr.* in Blumea 3: 162 (1938); Bor, Fl. Iraq 9: 496, t. 191 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 754 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 677 (1978).

Panicum divisum Gmel. in L., Syst. Nat., ed. 13, 2: 156 (1791). *Pennisetum dichotomum* (Forssk.) Del., Fl. aegypt Ill. 159 (1813); Boiss., Fl. Orient. 5: 444 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 700 (1933); Täckh. et Drar, Fl. Egypt 1: 465 (1941).

A bushy desert grass growing in large thickets with ascending woody culms, up to 150 cm tall, from a very stout woody rootstock. Leaf-blades rigid, pungent. Empty leaf-sheaths large, yellow at the swollen nodes. Inflorescence cylindrical, somewhat dense, 4–10 cm long, 10 mm wide. Spikelets solitary, rarely in pairs, seated in an involucre of unequalling long, antrorsely scabrid bristles, free from the very base.

The plant is very comon in Qatar, especially in the south. It grows in depressions and wide long runnels and wadis where soil is mainly deposited through the action of water. In some habitats, it may grow in association with *Panicum turgidum* and/or *Lasiurus hirsutus*, then it is not grazed while *Panicum* in the same site is obviously overgrazed. This shows that the plant is not preferred by grazing animals.

The plant flourishes earlier than *Panicum* and flowers from March to May.

Local name: *Dáah* or *Thaymoum* (Plate 119).

29. *PHALARIS* L.

Annual or perennial grasses with linear, flat leaf-blades. Inflorescence an ellipsoid or oblong panicle. Spikelets strongly compressed, 3-flowered. The lower 2 florets sterile and the upper hermaphrodite. Glumes equal, boat-shaped, often winged on the keel, usually white with prominent green nerves. Grain compressed, ellipsoid.

1. Spikelets all alike, fertile . . . . 1. *P. minor*
2. Spikelets fertile and sterile, all falling entire . 2. *P. paradoxa*

1. *Phalaris minor* *Retz.*, Obs. Bot. 3: 8 (1783); Boiss., Fl. Orient. 5: 472 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 1: 714 (1933); Täckh. et Drar, Fl. Egypt 1: 402 (1941); Bor, Fl. Iraq 9: 364, t. 139 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 741 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 736 (1978).

A tufted annual with erect culms up to 1 m tall, glabrous, smooth. Leaf-blades flat, linear acuminate, up to 15 cm long. Upper leaf-sheaths slightly inflated. Inflorescence a dense oblong or ovate–cylindrical panicle. All spikelets alike, 4·5–5·5 mm long: glumes compressed, winged on the keel; wing with one or more teeth.

A common weed in the cultivated land and along irrigation channels. Flowering from March to April.

2. *Phalaris paradoxa* *L.*, Sp. Plant., ed. 2, 1665 (1763); Boiss., Fl. Orient. 5: 472 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 714 (1933); Täckh. et Drar, Fl. Egypt 1: 404 (1941); Bor, Fl. Iraq 9: 366, t. 140 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 741 (1974).

Annual tufted grass with fasiculate culms, geniculate at the base, finally erect, glabrous. Leaf-blades linear–acuminate, 15 cm long. Panicle oblong, obovate, rarely cylindrical, the base often enclosed in the uppermost spathe-like leaf-sheath. Spikelets in groups of 1 large fertile spikelet surrounded by 5–6 sterile reduced ones. Fertile spikelets compressed; glumes 6–8 mm long, with a tooth-like wing from the middle of the dorsal keel.

A common weed in gardens and cultivated *rodat*. Flowering from March to April.

30. *PHRAGMITES* ADENS.

Perennial robust reed with creeping rhizomes and hollow culms. Panicle large, triangular in outline. Spikelets 2–10-flowered. Rachilla disarticulating above the glumes and between the lemmas, long pilose with silky hairs. Glumes unequal.

Phragmites: from the Greek name of a reed grown in hedges—the adjective *phragmites* denotes appertaining to a fence or screen, apparently suggested by its hedge-like appearance when growing along ditches.

1. *Phragmites australis* *(Cav.) Trin. ex Steud.*, Nom. Bot. ed. 2, 2: 324 (1841); Bor, Fl. Iraq 9: 374, t. 143 (1968); Täckh., Stud. Fl. Egypt, ed. 2. 697 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 754 (1978). *Arundo phragmites* L., Sp. Plant., ed. 1: 81 (1753). *A. australis* Cav. in Anal. Hist. Nat. 1: 100 (1709). *Phragmites communis* Trin., Fund Agrost. 134 (1820); Boiss., Fl. Orient. 5: 563 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 745 (1933).

A stout, rhizomatous perennial, reed-like grass up to 4 m tall; culms simple, erect, rigid,

smooth and glabrous. Leaf-blades flat, tapering to a long filiform tip. Panicle large, up to 30 cm long, much branched, purplish to brownish finally silvery. Spikelets widely gapping, 2–6-flowered; rachilla covered with long cilia.

The plant is fairly common in Qatar, growing along ditches of brackish water and in moist waste places in the cultivated areas. A vast area to the south of Doha is occupied by a dense growth of *Phragmites* due to the continuous spilling of sewage in that area (Plate 120).

31. *POA L.*

Annual or perennial grasses. Ligules scarious. Inflorescence a panicle, open or contracted. Spikelets small, compressed, 2 to several-flowered, keeled, awnless. Glumes subequal, shorter than spikelet, the lower 1-nerved, the upper 3-nerved.

1. ***Poa annua*** *L.* Sp. Plant., ed. 1: 68 (1753); Boiss., Fl. Orient. 5: 601 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 758 (1933); Täckh. et Drar, Fl. Egypt 1: 173 (1941); Bor, Fl. Iraq 9: 122 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 686 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 781 (1978).

Annual or short-lived perennial smal grass. Culms flattened with open, pyramidal, lax panicle with a few spreading branches carrying few spikelets; lemmas broadly hyaline, silky hairy on the lateral and keel nerves.

A rare weed in Qatar occurring mainly in lawns. Flowering from March to April.

32. *POLYPOGON DESF.*

Annual or perennial grasses with flat leaf-blades. Inflorescence a very dense, bristly panicle of many small, awned spikelets. Spikelets 1-flowered, falling entire at maturity. Glumes subequal, awned or awnless. Lemmas awnless.

Polypogon: from the Greek, *polu*, many, *pogon*, beard, referring to the numerous crowded awns.

1. ***Polypogon monspeliensis*** *(L.) Desf.*, Fl. Atlant. 1: 67 (1798); Boiss., Fl. Orient. 5: 520 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 730 (1933); Bor., Fl. Iraq 9: 318, t. 115 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 715 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 694 (1978).
Alopecurus monspeliensis L., Sp. Plant., ed. 1, 61 (1753).

Annual with loosely tufted or solitary, smooth and glabrous culms 15–45 cm tall. Leaf-blades flat, dark green, up to 15 cm long. Panicle of a pale bristly aspect, soft, very dense, oblong, cylindrical, sometimes lobed, 2–12 cm long. Spikelets 2–3 mm long. Glumes unequal, 1–2 mm long, both ending in a 3–4- (–7-) mm long straight awn. Lemma half as long, short-awned.

A common weed, especially in moist sandy places, along irrigation channels.

Local name: *Dail Al-Qutt*. Flowering from March to May (Plate 120).

33. *SCHISMUS P. BEAUV.*

Small annual tufted grasses with filiform leaves. Ligule a rim of hairs. Inflorescence a

panicle, usually dense, with spikelets on short pedicels crowded on and articulated to the branches. Spikelets compressed awnles, 5–10 bisexual florets, or the uppermost reduced. Glumes subequal, strongly nerved with scarious margins. Lemma bifid (*schisma*, cleft).

1. *Schismus barbarus* *(L.) Thell.* in Ball. Herb. Boiss. Ser. 2, 7: 391 (1907); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 757 (1933); Täckh. et Drar, Fl. Egypt 1: 314 (1941); Bor, Fl. Iraq 9: 378, t. 144 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 708 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 781 (1978).

S. calycinus (L.) Duval. Jouve in Billot, Annot. 289 (1855); Boiss., Fl. Orient. 5: 597 (1884).

Erect or prostrate small annual grass, often forming small tufts with very numerous smooth and glabrous culms, 7–15 cm tall. Leaf-blades very narrow, involute. Inflorescence a compact erect panicle, green or purplish, about 3 cm long and 1 cm broad. Spikelets 4–7 mm long, each with 5–10 fertile florets and a rudimentary upper one; rachilla articulated. Glumes almost equal, acute, glabrous, persistent. Lemma 2–3 mm long, 2-lobed, hairy in the lower half, lobes obtuse or acute.

Very common in Qatar; it grows in various habitats: it is grazed by animals. Flowering from February to March (Plate 121).

34. *SETARIA P. BEAUV.*

Mostly annual grasses with flat leaf-blades. Inflorescence terminal, spike-like, cylindrical panicle. Spikelets awnless, pedicelled, supported by 1 to several yellowish or reddish, scabrid, persistent bristles. Spikelets with 2 florets, the lower male, the upper bisexual. Glumes unequal.

Setaria: from the Greek *seta*, bristle, referring to the bristles (vestigal branches) on the peduncle of the spikelet.

1. Bristles retrosely scabrous, i.e. with the minute prickles directed downwards (seen with a lens or felt with the finger) . . . . . . 1. *S. verticillata*
2. Bristles antrorsely scabrous, i.e. with the prickles directed upwards . 2. *S. viridis*

1. *Setaria verticillata* *(L.) P. Beauv.*, Ess. Agrost. 51, 178 (1812); Boiss., Fl. Orient. 5: 443 (1884); Täckh. et Drar, Fl. Egypt 1: 459 (1941); Bor., Fl. Iraq 9: 503, t. 193 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 753 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 676 (1978).

Panicum verticillatum L. Sp. Plant., ed. 2, 82 (1762).

A densely tufted annual grass, up to 90 cm tall. Culms spreading, geniculate, much branched at base. Leaf-blades flat, scabrous, glabrous or pilose. Panicle green or purplish, 3–10 cm long, cylindrical, interrupted especially below. Spikelets often solitary and supported by 1 to several bristles, 2 mm long, retrose-scabrous, 1–3 times as long as the spikelet.

A common weed in moist ground in damp shady gardens, especially palm groves. Flowering in the summer.

2. *Setaria viridis* *(L.) P. Beauv.*, Ess. Agrost. 51, 171, 178 (1812); Boiss., Fl. Orient. 5: 443 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 699 (1933); Täckh. et Drar, Fl. Egypt 1: 461

(1941); Bor, Fl. Iraq 9: 504 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 754 (1974); Migahid, Fl. Saudi Arab, ed. 2, 2: 670 (1978).
Panicum viride L., Syst. Nat., ed. 10, 870 (1759).

Annual grass with erect or geniculate culms up to 30 cm tall. Panicle an erect, cylindrical, false-spike. Spikelets 1 to several in a group, seated on cushion-tipped pedicels and supported by an involucre of 1–3 greenish or purplish bristles, antrorsely scabrid, 3–4 times as long as the spikelet. Spikelets 2–3 mm long; upper glume as long as the upper lemma.
Rare weed in Qatar; in moist places in gardens.

35. *SORGHUM MOENCH*

Usually tall annual or perennial grasses, with stout, erect culms, flat leaf-blades and large, terminal naked panicle (in certain cultivated species, compact and head-like). Each spikelet pair of 1 sessile fertile and 1 pedicelled male spikelet. Awn from the sinus of the bifid lemma, deciduous.
Sorghum from *Sorgo*, the Italian name of the plant.

1. *Sorghum halepense* *(L.) Pers.*, Syn. 1: 101 (1805); Boiss., Fl. Orient. 5: 459 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 707 (1933); Bor, Fl. Iraq 9: 548 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 762 (1974).
Holcus halepensis L., Sp. Plant., ed. 1, 1047 (1753).

A perennial grass, with culms up to 150 cm tall (shorter under our conditions), silky-pubescent at the nodes, erect from stout scaly rhizome. Leaf-blades linear-acuminate, flat. Panicle large, pyramidal, 15–20 cm long with verticillate branches and rather small spikelets. Sessile spikelets ovate, covered with short hairs, 4–5 mm long, awned; pedicellate spikelets 5–7 mm long, lanceolate, much narrower than the sessile.
Rare in the cultivated areas under permanent irrigation. Flowering in the summer.

36. *SPOROBOLUS R. BR.*

Stiff perennial grasses of pale colour with creeping stolons and often pungent leaves. Ligules a rim of hairs. Spikelets minute, disarticulating above the glumes, 1-flowered, awnless in a narrow spike or panicle. Glumes unequal. Unlike most other grasses, grain with free pericarp.

\+ Leaves not pungent; spike pyramidal in outline, 4–5 cm broad . . 1. *S. arabicus*
\+ + Leaves pungent; spike narrow, 2–3 mm broad . . . . 2. *S. spicatus*

1. *Sporobolus arabicus* *Boiss.*, Diagn. Pl. Or. Nov., Ser. 1, 13: 47 (1853); Blatt., Fl. Arab. 6: 499 (1936); Bor, Fl. Iran. 70: 456 (1970); Migahid, Fl. Saudi Arab., ed. 2, 2: 738 (1978).
S. pallidus (Nees) Boiss., Fl. Orient. 5: 512 (1884).
S. marginatus auct mult., non Hochst. ex A. Richard (1851).

Perennial grass with stolons and many erect dense culms. Leaves glabrescent, involute or convolute, narrow, lanceolate, tapering into an acute point, 25 cm long, 2–3 mm broad, margins ciliate. Panicle open, 20 cm long, pyramidal in outline, with branches up to 2·5 cm

long. Spikelets linear–lanceolate, up to 2 mm long. Lower glume 0·5 mm long with obtuse or truncate apex. Upper glumes 1·7 mm long, more or less acute. Lemma 1·9–2·4 mm long.

Common in Qatar. It dominates a community abounding in depressions and runnels with saline soils. Flowering in the spring and early summer (Plate 121).

2. *Sporobolus spicatus* *(Vahl) Kunth*, Rév. Gram. 1: 67 (1829).; Täckh., Stud. Fl. Egypt, ed. 2, 716 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 738 (1978).

Perennial grass with naked creeping rhizomes, which may be several metres long, with tufts of leaves and short culms at the rooting nodes. Leaves rough–scabrous above, glabrous on lower surface; blades linear involute, pungent; sheaths long. Spike narrow, acute, long peduncled, 5–6 cm long, 2–3 mm broad.

Occasional in Qatar in moist saline habitats. Flowering from March till the early autumn.

37. *STIPA* L.

Perennial, rarely annual (our species) grasses with convolute, sometimes flat, leaf-blades. Panicle effuse or contracted, of pedicelled spikelets. Spikelets 1-flowered, deciduous above the glumes. Glumes membraneous, long and narrow, acuminate to aristate pointed. Lemma very firm, narrow, convolute, awned. Awn very long, usually with a twisted column and a bristle, glabrous or hairy.

1. *Stipa capensis* *Thunb.*, Prodr. pl. 19 (1794); Täckh. et Drar, Fl. Egypt 1: 354 (1941); Bor, Fl. Iraq 9: 402, t. 151 (1918). Täckh., Stud. Fl. Egypt, ed. 2, 721, t. 264 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 738 (1978).

S. tortilis Desf., Fl. Atlant. 1: 99, t. 31 (1798); Boiss., Fl. Orient. 5: 500 (1884), Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 725 (1933).

S. retorta Cav., Obs. Hist. Nat. R. Valenc. 1: 119, 2: 325 (1795–97); Maine, Fl. Afr. Nor. 2: 68 (1953).

Annual tufted grass, profusely branched at the base. Leaf-blades erect, narrow, convolute; sheaths lax, the uppermost often inflated and including the base of the inflorescence. Panicle rich, dense, contracted after flowering. Spikelets silvery, very densely crowded. Glumes longer than the floret, upper glume 20 mm, lower glume 18 mm long. Awns 8–10 cm long, shortly hairy, twice kneed and eventually twisted together into a characteristic, erect tail.

This annual grass is very common in Qatar. After rains, this plant forms green mantle covering the ground surface in the *rodat*, particularly those having water-borne material deposited in. During the flowering time, the silvery spikelets appear waving with the wind.

When young, this plant is palatable. However, when the grass is fruiting it can be injurious to animals. The spear-like grain is armed with a very sharp callus and a long slender awn, spirally coiled like a corkscrew, which twists or untwists as the humidity of the air varies. The twisting action helps to drive the grass seed into the ground and they are prevented from being easily dragged out of the ground by retrorse hairs on the callus.

The local name is *Sama'a*. Flowering from March to April (Plate 122).

38. *STIPAGROSTIS NEES*

Densely tufted, perennial grasses. Leaf blades rolled or folded, subterete; ligule a dense fringe of hairs. Inflorescence a panicle. Spikelets 1-flowered, hermaphrodite, short-pedicelled. Glumes persistent. Lemma ending in a 3-parted awn, of which the central one is usually plumose, the lateral branches naked; less frequently all branches plumose.

Stipagrostis from the Greek, *Stupe*, tow, an allusion to the plumose awns, and *agrostis*, a fodder grass.

\+ Feather obtuse, culm 1-noded; basal leaf-blades very short, circinate . . . 1. *S. obtusa*
\+ + Feather acute with exserted naked tip, culm several-noded; leaf-blades flexuous or circinate . . . . 2. *S. plumosa*

1. *Stipagrostis obtusa* *(Del.) Nees*, Linnaea 7: 293 (1832); Bor, Fl. Iraq 9: 388 (1968) et Fl. Iran. 10: 374 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 725 (1974).

Aristida obtusa Del., Fl. Egypt 175, pl. 13, f. 3 (1813); Boiss., Fl. Orient. 5: 494 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 722 (1933); Täckh. et Drar, Fl. Egypt 1: 362 (1941).

A tufted perennial in which the culms emerge from the closely packed sheathed bases; culms 5–30 cm tall, conspicuously 1-noded, erect. Leaf-blades often very short, filiform, curved, with white hairs on the upper surface; lower sheaths persisting, more or less hairy on the margins. Panicle narrow, 10–12 cm long, or shorter. Spikelets about 10–12 mm long; central branch of awn plumose, naked in lower third, about 25 mm long, lateral branches naked, up to 15 mm long. Feathers obtuse.

Common on compact soil and in gravelly habitats. It is locally abundant in depressions along roads. The common name is *Nassi* and the plant flowers in April and May (Plate 122).

2. *Stipagrostis plumosa* *(L.) Munro ex T. Anders.*, Journ. Linn. Soc. Bot. 5, suppl. 1: 40 (1860); Bor, Fl. Iraq 9: 389, t. 148 (1968) et Fl. Iran. 70: 371 (1970); Täckh., Stud. Fl. Egypt, ed. 2, 726 (1974).

Aristida plumosa L., Sp. Plant., ed. 2, 2: 1666 (1763); Boiss., Fl. Orient. 5: 495 (1884); Täckh. et Drar, Fl. Egypt 1: 366 (1941).

A perennial, densely caespitose grass, with erect or shortly geniculate culms, up to 40 cm tall; nodes and internodes (particularly the lower covered with wool, lower sheaths covered with a fugacious wool (in all other species glabrous)). Leaf blades rigid, convolute, filiform, flexuous, often curved in a half or full circle. Inflorescence a panicle about 15 cm long; lateral branches of the awn naked up to 20 mm, the central plumose-ciliate in the upper two-thirds, and 2·5–6 cm long. It is a multiform species.

The plant is common in Qatar. It grows on gravelly and stony ground where the plant accumulates a small heap of sand around its body. The root hairs of the plant collect sand particles which form a loose tube round the rootlets; this possibly helps the retention of moisture which may be used by the plant. The plant is considered a good fodder. In some parts of Arabia (e.g. Al-Hamra, Saudi Arabia) the author saw large amounts of this plant collected from the north Hejaz, dried and sold as hay.

The common name for this grass in Qatar as well as other Arab countries is *Nassi*.

Flowering is mainly from March to May (Plate 123).

39. *TRACHYNIA LINK*

Annual grasses with flat leaf-blades. Spikelets all similar, large, lanceolate, many-flowered, either solitary terminal or a few subsessile, alternate in a contracted raceme. Glumes unequal. Lemma awned.

1. ***Trachynia distachya*** *(L.) Link*, Hort. Bot. Berol 1: (1827); Täckh. et Drar, Fl. Egypt 1: 161 (1941); Bor, Fl. Iraq 9: 168, t. 58 (1968); Täckh., Stud. Fl. Egypt, ed. 2, 683 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 755 (1978).

Brachypodium distachyon (L.) P. Beauv., Ess. Agrost. 101, 155 (1812); Boiss., Fl. Orient. 5: 657 (1884); Post, Fl. Syr., Pal. et Sinai, ed. 2, 2: 777 (1933).

Bromus distachyas L., Cent. 2: 8 (1756).

A glaucus annual with stiff culms, 10–30 cm high. Leaf-blades flat, short and broad. Inflorescence a solitary terminal or 2 or 3 (rarely more) shortly pedicelled, crowded spikelets. Spikelets 2–3 cm long, laterally compressed, up to 20-flowered. Glumes unequal, awnless. Lemmas awned; awns much longer than the lemmas, straight.

An occasional grass in cultivated land and in *rodat* with deep alluvial sediments. Flowering from March to April.

54. *PALMAE A. JUSS.*

Woody plants with unbranched stem (our species), often with suckers at the base. Leaves stiff, evergreen, with sheathing base, and pinnate (our species) or palmate blade, usually forming a crown at the summit of the trunk. Inflorescence a branched spadix enclosed in several spathes. Flowers numerous, small, monoecious or dioecious, rarely bisexual Perianth 6-parted in 2 series. Stamens typically 6; carpels 3. Fruit a berry, drupe or nut.

1. *PHOENIX L.*

A tree with undivided stem and pinnate large leaves; leaflets folded upwards. Fruit a fleshy drupe 'date', containing a solitary stone deeply furrowed on the ventral side.

1. ***Phoenix dactylifera*** *L.*, Sp. Plant., 992 (1753); Boiss., Fl. Orient. 5: 47 (1884).

A dioecious tree with small white flowers on a richly branched spadix, surrounded by a solitary large spathe. Calyx cup-shaped, 3-toothed; petals 3, in female flowers twice as long as the calyx. Stamens 6 with linear dorsifixed anthers. Ovaries 3, but only 1 developing into fruit. Fruit usually cylindrical, occasionally rounded or ovoid, with fleshy sugary pericarp.

The plant is cultivated in Qatar. Spontaneous growth of this species is observed along the shores of the Arabian Gulf opposite Umm Bab in the area known as Al-Hamla. Al-Hamla means the neglected.

55. *TYPHACEAE A. JUSS.*

Marsh or aquatic plants with rhizomes. Leaves alternate, linear, 2-ranked, sheathing at

base. Flowers small, naked, in dense cylindrical spikes, the female below, the male above. Female flowers of a single carpel with long style and spindle-shaped stigma. Male flowers of 2–5 stamens. Fruit a nutlet.

1. *TYPHA L.*

Tall marsh plants, often more than a man's height, with stout creeping rhizomes. Leaves long, linear. Flowers small, naked, in a very dense cylindrical spike, of which the upper part consists of male flowers, the lower part of green, later brown female flowers. Fruit a nutlet, surrounded by hairs.

1. *Typha domingensis* *Pers.*, Syn. Pl. 2: 532 (1807); Graebner in Engl. et Prantl, Pflanzenfam. IV, 8: 14 (1900); Täckh., Stud. Fl. Egypt, ed. 2, 769 (1974); Siddiqi, Fl. Lib. 20: 2 (1977); Migahid, Fl. Saudi Arab., ed. 2, 2: 787 (1978).

T. angustifolia L. ssp. *australis* (Schum. et Thonn.) Graebner in Engl. et Prantl, 13, l.c.; Rech., Fl. Lowland Iraq 25 (1964). *T. angustata* Bory et Chaub. in Bory, Exped. Sci. de Moree. 3; 2 (1833). *T. australis* Schum et Thonn, Beskr. Gim. Pl. 401 (1829); Täckh. et Drar, Fl. Egypt 1: 87 (1941).

Perennial, 1·5–3 m tall herb. Stem stout. Leaves erect, linear, leathery, up to 1·5 m long 8–12 mm wide, flat above and round-backed. Inflorescence an interrupted, cylindrical spadix, staminate and pistillate parts separated by 1–3 cm long internode. Female spike light brown, 20–25 mm broad, about 15 cm long; male spike 17–34 cm long, 7–12 mm broad.

The plant is reported from Qatar in 2 localities; Ras Ushirij and Al-Wabrah. It grows in marshy habitats where there is a continuous spilling of water; near a tap at Ras Ushirij and a water reservoir at Al-Wabrah. Flowering specimens were collected in May from Ras Ushirij. In this locality, *Scripus maritimus* L. grows along the periphery and mixed with *Typha* growth. At Al-Wabrah, *Typha* grows in a channel draining a water reservoir. Local name: *Bordi.*

The leaves of this plant are used in other countries, where it covers vast areas, for weaving baskets, mats and in spinning coarse ropes. Whole plants are used for papermaking and as a cattle feed (Plate 124).

56. *CYPERACEAE A. JUSS.*

Grass- or rush-like, usually perennial, often rhizomatous herbs, with usually solid, triangular culms. Leaves usually linear, eligulate, with closed sheaths. Flowers several together in spikelets, these in compound inflorescences; each flower in the axis of a glume (or inside a flask-shaped glume, *Carex*), consisting of 3 stamens and 2–3 stigmas of various shape, mostly slender; sometimes a reduced perianth present in the form of bristles or hairs. Fruit a nut.

I. Spikelets flat with 2-ranked glumes . . . . . 1. *Cyperus*
II. Spikelets terete without imbricated glumes . . 2. *Scirpus*

1. *CYPERUS* L.

Annual or perennial (our species) herbs, with leaves sheathing at base, sometimes reduced to simple sheaths. Spikelets usually many-flowered, flat with 2-ranked glumes, commonly arranged in an umbel or a head. Perianth absent, stamens 3, sometimes reduced to 2 or 1. Style 3- (–2-) cleft. Fruit lenticular or trigonous.

I. Spikelets in spikes . . . . 3. *C. rotundus*
II. Spikelets in digitate clusters or in heads . . . . .
 1. Spikelets few in a simple, lateral, sessile cluster . . 2. *C. laevigatus*
 2. Spikelets numerous in a terminal head, or in umbel rays 1. *C. conglomeratus*

1. *Cyperus conglomeratus* *Rottb.* Descr. et Icon. 21, t. 15, f. 7 (1773); Raymond in Rech., Fl. Lowland Iraq 425 (1964); Täckh., Stud. Fl. Egypt, ed. 2, 784 (1974); Migahid, Fl. Saudi Arab., ed. 2, 2: 789 (1978).
C. pungens Boeck. (1868).

Densely tufted, pale green perennial herb with coarse rootlets heavily covered with felt-like hairs. Stems compressed, obtuse-angled, leafy at base. Leaves terete, grooved, pungent. Inflorescent either of 2–4 short umbel-rays or forming a dense head, about 25 mm across. Bracts 2–4, sometimes a continuation of the stem. Spikelets 6 or more together, pale, 8–18-flowered. Stigmas 3; nut trigonous.
It is a multiform species, the following varieties are recorded in Qatar:

A. Spikelets 20–45 mm long, 6 mm broad, umbel 1–2-rayed, rays with 1–3 spikelets . . . . 1. var. *aucheri*
B. Spikelets mostly 3 mm broad.
 1. Leaves rigid, pungent . . . . 2. var. *effusus*
 2. Leaves at least flat at base, convolute, less pungent . . 3. var. *multiculmis*

1. Var. ***aucheri*** (Jaub. et Sp.) C.B. Cl. (1895).
Stem thick, stout, terete, umbel 1–2-rayed (in type 2–4), rays with 1–3 spikelets (in type 6 to more). These are straw-coloured or white, glossy, very large, up to 45 mm (in type 10–20 mm).
In sandy habitats in southern Qatar, Emirates' road and Abu Samra.

2. Var. ***effusus*** (Rottb.) Kukenth. (1936).
Stems terete or trigonous upwards. Leaves rigid, pungent. Spikelets like in the next variety brown and often torted. This variety is represented in Qatar by the dwarf form f. *curvulus* Boeck (1868) with stems only a few centimetres high, shorter than the curved leaves and with only 2–6 spikelets in a solitary head.
On maritime sand at Ras Ushirij and on gravelly soil along the road to Al-Khor.

3. Var. ***multiculmis*** (Boeck.) Kuckenth. (1936).
Stem slender, often trigonous upwards. Leaves plane at base, upwards long, narrow, convolute, less pungent. Umbel-rays up to 7. Spikelets 2–3 mm broad, 16–40-flowered. Glumes densely imbricated, mucronate, often brownish.
On coarse sandy soil; collected at Doha.
The species is a common plant observed in various sandy habitats, both coastal and inland. Flowering in different seasons, mainly in the spring (Plate 124).

2. *Cuperus laevigatus* *L.*, Mant. pl. 2: 179 (1771); Täckh. et Drar, Fl. Egypt 2: 43 (1950); Raymond in Rech., Fl. Lowland Iraq 4277 (1964), Migahid, Fl. Saudi Arab., ed. 2, 2: 788 (1978).

Perennial rhizomatous plant, the culms either crowded on a short rhizome or interspaced in rows on a long creeping rhizome. Culms compressed, trigonous, rigid, 10–15 cm high, grooved. Leaves reduced to 2–3 dark brown sheaths. Bracts 2, the lower erect as if continuing the stem, the other much shorter and patent. Inflorescence a capitate pseudolateral head of 1–12, oblong or linear–lanceolate, acute spikelets, 4–10 mm long, 2 mm wide, 12–24-flowered. Stigmas 2, nut dorsally compressed, turning the face to the rachilla.

Rare in Qatar; recorded only in south-west Qatar near Abu Samrah in a locality where brackish water accumulates. It dominates a community in that locality. Flowers all the year (Plate 124).

3. *Cyperus rotundus* *L.*, Sp. Plant., 67 (1753); Täckh. et Drar, Fl. Egypt, 2: 69 (1950); Raymond in Rech., Fl. Lowland Iraq 423 (1964); Migahid, Fl. Saudi Arab., ed, 2, 2: 789 (1978).

Perennial herb, sending long slender stolons bearing ellipsoid black tubers and often producing long rows of small leaf rosettes along the ground. Culms 15–30 cm high, triquetrous, densely leafy at base. Leaves numerous, all basal, 2–6 mm wide, greenish, rigid. Inflorescence compound or simple. Rays of umbel 3–9, unequal, up to 6 cm long. Bracts 2–4, the longer ones overtopping the umbel. Spikelets linear–lanceolate, 10–20 mm long, 2 mm wide.

It is an extremely variable species with various subspecies and forms.

The plant is common in gardens and cultivated fields, particularly on moist ground. Flowering all the year. Local name: *Se'd.*

2. *SCIRPUS* L.

Annual or perennial (our species) herbs. Spikelets many-flowered, solitary or (in ours) several, terete with imbricated glumes arranged in a terminal (our species) or falsely lateral head- or umbel-like inflorescence. Perianth absent or reduced to a few hypogenous bristles. Stamens 1–3. Style glabrous, filiform, persistent. Stigmas 2 or 3. Fruit obovoid, trigonous or biconvex.

1. *Scirpus tuberosus* *Desf.* Fl. Atl. 1: 50 (1798–1800); Täckh. et Drar, Fl. Egypt 2: 27 (1950); Raymond in Rech., Fl. Lowland Iraq 129 (1964).

A perennial with a creeping rhizome with the runners dilated in woody tubers. Culm erect, about 50 cm, triquetrous. Leaves linear, less than 5 mm wide, bright green; their long imbricated sheaths concealing the lower part of the stem. Bracts of the inflorescence 3–5, foliaceous, the longer ones overtopping the inflorescence. Spikelets cylindrical, 1–2 cm long, 5–6 mm wide. Nut 2·5 mm long, dark brown, trigonous, supported by 6 fragile, unequal bristles which are shorter than the nut.

Rare in Qatar; recorded only at Ras Ushirij in a locality receiving spilled water continuously. It grows along the margins of a patch inhabited by *Typha domingensis*. Flowering in the spring and early summer.



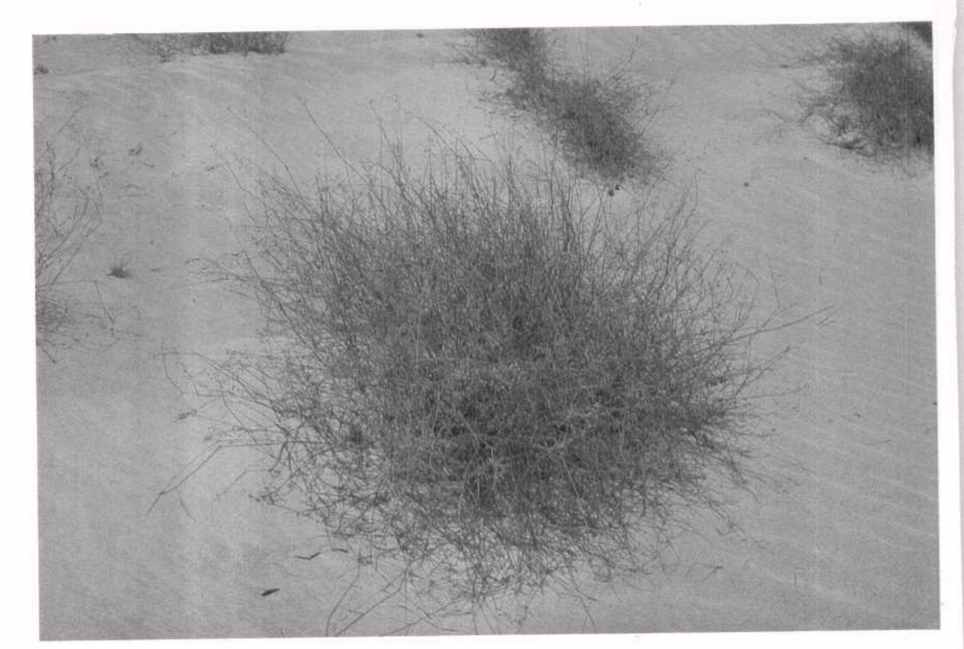
Eragrostis barralleri Daveau.



Eragrostis ciliaris (L.) R. Br.



Eragrostis cilianensis (All.) Vign.



Panicum turgidum Forssk.

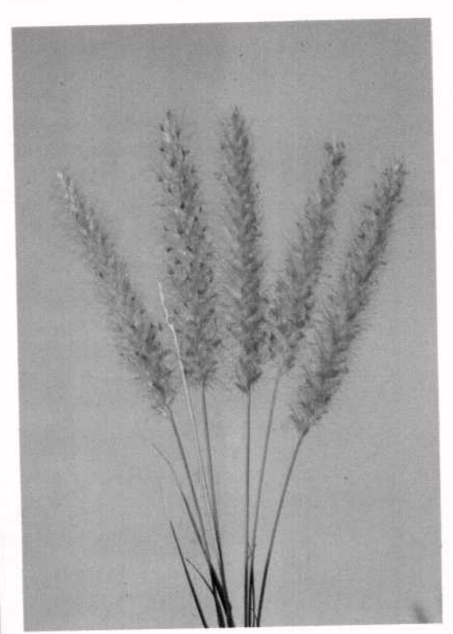


Panicum turgidum Forssk.

PLATE 118



Pennisetum divisum (Gmel.) Henr.



Pennisetum divisum (Gmel.) Henr.



Lasiurus hirsutus (Forssk.) Boiss.



Polypogon monospliensis (L.) Stapf.



Hordeum glaucum Steud.



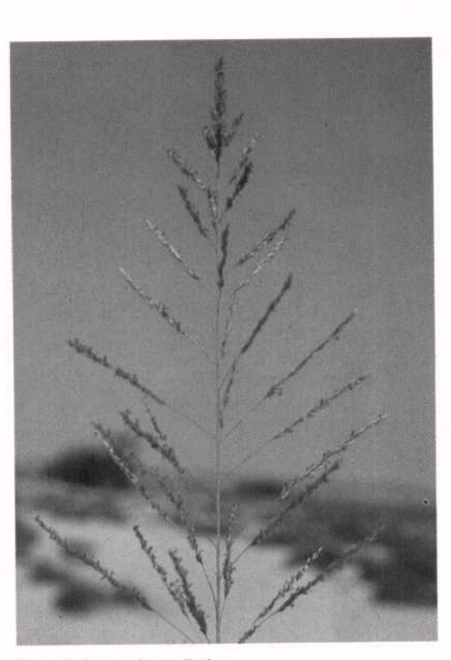
Phragmites australis (Cav.) Trin. ex Steud.



Schismus barbatus (L.) Thell.



Sporobolus arabicus Boiss.



Sporobolus arabicus Boiss. .



Stipagrostis obtusa (Del.) Nees.



Stipa capensis Thumb.



Stipagrostis obtusa (Del.) Nees.



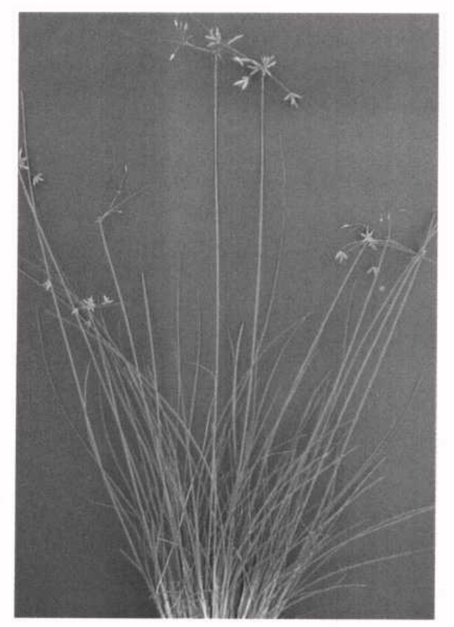
Stipagrostis plumosa (L.) Munro ex T. Anders.



Stipagrostis plumosa (L.) Munro ex T. Anders.



Chrysopogon aucheri (Boiss.) Stapf. growing in a runnel with *Acacia tortilis*.



Cyperus conglomeratus Rottb. var. *aucheri*.



Cyperus conglomeratus Rottb. var. *multiculmis*.



Cyperus laevigatus L.

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ABBREVIATIONS USED IN THE TEXT

auct. (*auctorum*)—of authors
ca. (*circa*)—about, approximately
cf. (*confer*)—compare
cit. (*citatus*)—cited by
comb. nova (*combinatio nova*)—new combination of words used in nomenclature, e.g. where a species is transferred for the first time from one genus to another
det. (*determinavit*)—identified by
e.g. (*exempli gratia*)—for example
emend. (*emendavit*)—altered by an author
et al. (*et alii*)—and others
etc. (*et cetera*)—and so on
f. (*forma*)—form of
f. after the proper name, *filius*—the son
fig. (*figura*)—figure (illustration)
fide—on the authority of
ibid. (*ibidem*)—in the same place
i.e. (*id est*)—that is to say
l.c. (*loco citato*)—in the place mentioned
leg. (*legit, legeunt*)—collected by
nom. nud. (*nomen nudum*)—name of a taxon published without a description
non (*non*)—not—e.g. DC non L (the species, etc.) of de Candolla, but not of Linnaeus
p.p. (*pro parte*)—in part, partly
q.v. (*quod vide*)—which see, to which refer
sphalm. (*sphalmate*)—by error
t. or tab. (*tabula*)—figure (illustration)
vide (*vide*)—see, refer to
viz. (*videlicet*)—namely

ADDENDUM

OCHRADENUS DEL. (page 93)

2. ***Ochradenus dewittii*** Abdallah Belmontia, N.S. Abdallah et De Wit, 8: 61–62 (1978).

Almost leafless, entirely glabrous shrublet. Stems slender, whiplike, finely ribbed. Flowers in terminal spicoid racemes. Sepals 5–7, tardily deciduous. Petals white, minute, as many as sepals, deciduous. Disc 2, the outer dish-shaped, the inner cup-shaped. Stamens 40–60. Capsule ovoid to ellipsoid (urn-shaped), over 1 cm long, *ca.* 5 mm wide, teeth triangular. Seeds caranculate.

The plant is very rare in Qatar. It has been collected near Al-Wukair in May 1981. The collected specimens were fruiting.

ARABIC GLOSSARY

A

Accrescent	يزداد حجمه بعد الازهار ، مثل الكأس :
Achene	فقيرة : ثمرة بسيطة جافة غير متفتحة بداخلها بذرة واحدة .
Actinomorphic	متعدد التناظر : وصف للزهرة التي يمكن قسمتها إلى قسمين متناظرين في أكثر من مستوى .
Aculeate, aculeolate	شائك ، ذو أشواك :
Acuminate	مستدق : وصف لقمة الورقة أو أجزاء الزهرة إذا استدقت لتصبح كزائدة طويلة رفيعة .
Acute	حاد أو مدبب :
Adhere, adherent	ملتصق : مثل التصاق المتك .
Adnate	ملتحم : صفة لعضو يلتحم مع آخر مسافة ما .
Alate	مجنح :
Alternate	مرتب في صفين : متبادل .
Amplexicaul	محتضنة الساق : وصف لقاعدة الورقة الجالسة العريضة عندما يلتف طرفاها الخالصان بعض الالتفاف حول محيط الساق .

Anastomosing
تشابك :
اتحاد تشعبات عروق الورقة أو القنابة لتكوين
جهاز وعائي شبكي .

Androecium
الأسدية في الزهرة :

Androgynous
سنبلة بها زهور مذكرة إلى أعلى وزهور مؤنثة إلى أسفل :

Annual
حولي :
صفة للنبات الذي يكمل دورة حياته في عام واحد .

Anthesis
إزهار :
تفتح الزهرة ، فترة تفتيح الأزهار .

Apiculate
مدببة :
وصف للأعضاء التي تنتهي فجأة بقمة صغيرة
مدببة .

Appressed (=adpressed)
متضاغطة :
وصف للأعضاء أو الأجزاء التي تتضاغط معا دون أن
تتحد .

Arcuate
قوسي :
يشبه القوس في انحنائه .

Aristate
شوكي :
مزود بسفاة أو شوكة طرفية حادة .

Articulate
مفصلي :

Ascendent, ascending
صاعد :
وصف للأعضاء النباتية التي تتخذ وضعا مائلا
نوعا ولكن متجها إلى أعلى .

Asperulous
خشن الملمس نوعا :

Auricle

أذنه :
زائدة تشبه الأذن في الأوراق أو البتلات .

Awl-shaped (=subulate)

مثقابي :
وصف للعضو الذي يشبه المثقاب في ضيقه واستدقاقه تدريجيا نحو قمة صلبة مدببة مثل أوراق البصل .

Awn

سفاة :
زائدة رفيعة كالشعرة .

Awned

ذو سفاة :
وصف للعضو الذي ينتهي بسفاة .

B

Baccate

لبي ـ لحمي :

Barb

شوكة خطافية :
شوكة كالشعرة ، معقوفة وتنتهي بخطاف .

Beak

منقار :
نتوء من بعض الثمار أو البذور يشبه المنقار .

Bearded (=barbate)

ملتحي :
وصف للعضو النباتي الذي يحمل شعورا أو سفا أو أشواكا دقيقة متجمعة على شكل لحية .

Berry

ثمرة لبية :

Biennial

ثنائي الحول :
نبات يعيش عامين ويثمر في العام الثاني .

Bifid

ثنائي التفصص ـ مشقوق :

Bifoliate

ذو وريقتين :

Bilabiate
ذو شفتين :

Bixesual
ثنائي الجنس ـ خنثوي :

Bract (adj. bracteate)
قنابة :
ورقة زهرية إضافية تخرج الزهرة في ابطها .

Bracteole
قنيبة :
ورقة زهرية إضافية ، أصغر من القنابة توجد عادة على عنق الزهرة .

Burr
فصلة ـ غلاف خشن :
السنيبلة أو مجموعة السنيبلات المتماسكة ، وهي تسقط من السنابل عند نضجها كوحدات .

C

Caducous
مبكر التساقط :
كالأوراق الخضرية والزهرية التي تسقط مبكرة .

Caespitose (=cespitose)
بساطي متكاثف :
كالنباتات التي تنمو في خصلات كثيفة وقصيرة مكونة بساطا أخضر كالحشائش .

Campanulate
ناقوسي الشكل :
كتويج بعض النباتات .

Canescent
مشعر :
مغطى بشعر رمادي أو زغب قصير .

Capitate
هامي :
متضخم القمة .

Capsule
علبة :
ثمرة بسيطة جافة متفتحة تنشأ من أكثر من كربلة ملتحمة .

Carpophore
حامل كربلي :
جزء من محور الزهرة يحمل الكرابل .

Catkin
نورة هرية :

Caudate
مذنبة :

Cauline (of leaves)
أوراق ساقية :
أي محمولة على ساق هوائية بعيدا عن الأرض .

Chaff (adj. chaffy)
قنابة حرشفية :
حرشفة صغيرة جافة غشائية تخرج الزهرة من ابطها ،
وتوجد في النورات المركبة .

Charataceous
ورقي :
له ملمس ورق الكتابة .

Ciliate
مهدب :
مزود بأهداب كالشعر .

Circumscissile
محيطية التفتح :
وصف للعلبة التي تفتح على امتداد خط دائري
حول محيطها ويتخذ الصمام العلوي شكل غطاء
لها .

Clasping
يحتضن الساق مثل الأوراق والقنابات والاذينات :

Claw (adj. clawed)
عنق السبلة أو البتلة الضيق :

Compressed
مفلطح من الجانبين :

Connivent
متلاقي ، متجمع ، متضام :
وصف للعضو أو الجزء الذي ينثني تجاه عضو آخر
حتى يلتقي به ويلامسه ولكن دون أن يتحد به .

Contiguous — متلامس :
العضو الذي يتلامس مع غيره سواء كان يشبهه أو
لا يشبهه دون اتحاد .

Contorted (twisted, colvolute) — ملتف ـ ملتوي :

Coriaceous — جلدي :
وصف للأوراق التي تكون كالجلد .

Corymb — نورة مشطية :

Crateriform — كأسي الشكل :
على شكل كأس أو حفرة ذات فوهة .

Crenate — مقروضة :
حافة الورقة ذات الأسنان الضحلة مستوية القمة .

Crispate (=crisped) — جعد أو مجعد :
وصف للورقة ذات السطح المجعد المتموج .

Cuneate, cuneiform — هودجي :
وصف للأوراق أو البتلات إذا كانت مثلثة الشكل
عريضة في أعلاها وتضيق تدريجيا نحو القاعدة .

Cupule — كؤيس :
تركيب يشبه الكأس الصغيرة عند قاعدة بعض الثمار .

Cuspidate — مدببة :
وصف للورقة التي تنتهي فجأة بقمة حادة مدببة .

Cyathium — نورة كأسية :
النورة المميزة للفصيلة السوسبية ، أزهارها وحيدة
الجنس يحيط بها في الصغر غلاف قنابي يشبه
الكأس .

Cymbiform — زورقي الشكل :

Cyme — نورة محدودة :

Cymose — لها أزهار في نورة محدودة :

D

Deciduous — متساقطة أو نفضية :

Decumbent — منبطح :
عضو مستلق على الأرض ولكن طرفه ناهض .

Decurrent — متدلي ملتصق :
وصف للعضو الذي يلتحم بالساق ويتدلى معها .

Decussate — متصالب :
وصف للأوراق المتقابلة إذا امتدت في مستويات متعامدة في العقد المتتالية .

Deltoid — دلتاوي :
مثلث الشكل .

Dentate — مسنن :
وصف لحافة الورقة إذا كانت بها نتوءات مدببة القمة متجهة للخارج .

Denticulate — دقيق التسنن :
ذو أسنان دقيقة .

Diadelphous — ثنائي المجموعة السدائية :
عندما تلتحم الأسديات لتكون مجموعتين .

Didynamous — رباعي الأسدية :
له سداتان طويلتان وأخريان قصيرتان .

Dioecious

ثنائي المسكن :
وصف النبات إذا كانت أزهاره وحيدة الجنس وتوجد الذكرية والانثوية منها على نباتات متفرقة كالبلح .

Diplostamonous

متبادلة الأسدية مع التويج :
وصف للأزهار التي تتبادل أسدياتها مع البتلات .

Disarticulating

متشدف :
متقطع إلى شدف

Disc-florets

زهيرات قرصية :
الأزهار الموجودة في مركز النورة الهامية في الفصيلة المركبة .

Downy

زغبي :
سطح مغطى بشعر قصير ناعم .

Drupe

حسلة :
نوع من الثمار الطرية غلافها الخارجي والأوسط طري والداخلي متحجر .

E

Ebracteate

عديم القنابات :

Echinate

شوكي :

Elliptic (=elliptical)

بيضي الشكل :

Emarginate

غائر :
وصف قمة الورقة عندما تكون منخفضة قليلا عن مستوى الحافة .

Entire

كاملة ـ مستوية :
وصف حافة الورقة إذا خلت من النتوءات

Ephemeral

موسمي :
نبات حولي ينهي دورة حياته في أسابيع قليلة .

Epigynous

فوق متاعية :
وصف للزهرة ذات المبيض السفلي أو الأجزاء
الزهرية المحمولة فوق المبيض .

Epipetalous

فوق بتلي :
كالأسدية التي تخرج من البتلات ولا تخرج من
التخت .

Exserted

بارز للخارج :
وصف للأجزاء التي تبرز خارج العضو الذي توجد به
كالأسدية التي تبرز خارج الغلاف الزهري في
بعض النباتات .

Exstipulate

عديمة الأذينات :

F

Falcate

منجلي الشكل ، معقوف :

Fascicle

خصلة :
وصف لخصلات الأوراق أو الألياف أو الأزهار
إذا تجمعت في حزم صغيرة مكتظة .

Fetid

كريه الرائحة :

Fid

مشقوق :

Filiform

خيطي :
يشبه الخيط في الدقة والاستطالة .

Fistulose (=fistular)

أسطواني أجوف :

Floccose

زغبي :
مغطى بشعر ناعم كالصوف يتساقط بسهولة .

زهيرة : | Floret

منقر : | Foveolate
وصف للجزء النباتي إذا كان به تجاويف صغيرة كالنقر .

شجيري : | Frutescent
متخشب .

مبكر التساقط : | Fugacious

G

متحد البتلات : | Gamopetalous

متحد السبلات : | Gamosepalous

ركبي : | Geniculate
ينحني كالركبة ويكون جزؤه العلوي زاوية مع الجزء السفلي .

محدودب : | Gibbous
منتفخ على أحد الجنبين ، وصف للعضو إذا انتفخ قرب قاعدته على جانب واحد ، كانتفاخ قاعدة التويج في زهرة حنك السبع .

أملس : | Glabrate
ناعم الملمس تقريبا أو يكاد أن يكون كذلك .

غير مشعر : | Glabrous
ولكنه ليس بالضرورة أملس ناعما .

غدي مشعر : | Glandular–pubescent
العضو النباتي الأشعر إذا كانت شعوره تنتهي بغدد أو الذي تختلط فيه الشعور بالغدد .

Glandular–punctate

غدي منقط :
وصف للعضو المزود بالغدد وبه نقط أو بقع بينها .

Glaucescent

شمعي نوعا :

Glaucous

شمعي أخضر مزرق :
وصف لسطح العضو النباتي ـ كالورقة ـ إذا كان مغطى بطبقة باهتة شمعية خضراء مزرقة سريعة الزوال .

Globose (=globular)

متكور :

Glomerate

متجمع :
وصف للأشواك أو الشعيرات المتجمعة في خصلات كثيفة .

Glume

قنبعة :
قنابة عقيمة توجد اثنتان منها في الناحيتين الأمامية والخلفية لكل سنيبلة .

Gynobasic

ناشىء من قاعدة المبيض :
وصف للقلم الذي يخرج من قاعدة المبيض لا من قمته .

Gynophore

حامل متاعي :
جزء من محور الزهرة يمتد في وسطها ويحمل المتاع .

H

Halophyte

نبات ملحي :
يعيش في بيئة ملحية .

Hastate

مزراقية :
ورقة مثلثة الشكل لها فصان خلفيان يتجهان جانبيا ، كورقة العليق .

Head	هامة : نورة سنبلية قصيرة مكتظة كروية كنورة البرسيم ـ النورة في الفصيلة المركبة .
Helicoid cyme	نورة قوقعية : نورة محدودة وحيدة الشعبة تتكون فروعها المتتالية على جانب واحد مما يسبب التفافها على شكل قوقعة .
Herbaceous	عشبي :
Hermaphrodite	خنثى ـ خنثوي :
Hirsute	أشعر خشن : مغطى بشعور أو أشواك شعرية خشنة .
Hirtellous	أشعر دقيق الشعر : وصف للسطح المغطى بشعر دقيق .
Hispid	أشعر شائك : مغطى بشعور شوكية حادة .
Hispidulous	شوكي الشعر نوعا : مغطى بشعر قصير يميل لونه إلى البياض .
Hoary	زغبي : سطح مغطى بشعر قصير يميل لونه إلى البياض .
Hyaline	شفاف :
Hypanthium	تخت كأسي : تخت أجوف يحمل المحيطات الزهرية على حافته والكرابل في داخل تجويفه .
Hypogynous	تحت متاعي : وصف للزهرة التي يكون فيها المبيض علويا .

I

Imbricate (=imbricated)

متراكب :

Imparipinnate

ريشية فردية :
وصف للورقة المركبة الريشية التي تنتهي بوريقة في قمتها .

Indehiscent

غير متفتح :

Inferior

سفلي :
وصف المبيض عندما يقع أسفل المحيطات الزهرية الأخرى ويلتحم جداره بالتخت .

Irregular flower

زهرة غير منتظمة :

K

Keel

زورق :

Keeled

زورقي :

Kneed

ركبي :
ذو مفصل عند قاعدة الساق الهوائية في النجيليات .

L

Laciniate

لسيني :
له فصوص ضيقة مدببة .

Lanate

صوفي :
مغطى بوبر يشبه الصوف .

Lanceolate

رمحي :

Latex

لبن نباتي :

Lax
سائب ـ مخلخل :
متشعب في حيز واسع ، كالنورات العنقودية المركبة لبعض النجيليات .

Legume
قرنة ـ قرن :

Lemma (=fertile glume)
عصيفة :

Locule
غرفة ـ مسكن :

Loculicidal
مسكني التفتح :
وصف للثمرة التي تتفح في وسط المساكن .

Lomentum
قرظة :
قرنة تنحصر بين البذور وتتقطع عند النضج إلى أجزاء وحيدة البذرة .

M

Mericarp
ثمرة جزئية :

Monadelphous
متحدة أنبوبية :
وصف للأسدية المتحدة بخيوطها في حزمة أنبوبية واحدة كما في الفصيلتين الخبازية والقرعية .

Monoecious
وحيد المسكن :
وصف للنبات ذي الأزهار وحيدة الجنس الذي تكون فيه الأزهار الذكرية والانثوية محمولة على نفس الفرد .

Mucro
قمة حادة :

Mucronate
شوكي الطرف :
ينتهي فجأة بشوكة أو قمة حادة ، ولكنها غير صلبة .

Mucronulate
شويكي الطرف :
ينتهي فجأة بشويكة أو قمة حادة صغيرة غير صلبة .

Muricate
خشن :
مغطى بنتوءات قصيرة حادة .

O

Oblong
مطول :
طوله أكبر كثيرا من عرضه وحافتاه متوازيتان تقريبا .

Obovate
بيضي مقلوب :
على شكل بيضة مقلوبة ـ أي قمتها المدببة إلى
أسفل .

Obtuse
كليل :
وصف قمة الورقة إذا كانت مستديرة وغير مدببة .

Ocrea (=ochrea)
أذينة غمدية :

Oligandrous (=oligostamenous)
قليل الأسدية :

Oligomerous
قليل الأجزاء :

Ovate
بيضي :

P

Palea
عصيفة عليا :
القنابه العليا (الداخلية) الواقعة في الجانب
الخلفي من زهرة النجيليات .

Papilionaceous
فراشي :
وصف للتويج المتميز إلى علم وجناحين في أزهار
الفصيلة الفراشية .

Pappus
زغب :

Parietal
جداري ، محيطي :

Pectinate
مشطي الشكل :

Pedicel
عنق الزهرة :

Peduncle
شمراخ :
المحور الذي يحمل الأزهار في النورة

Peduncled
معنق :

Pellucid
شفاف ، رائق :

Pentamerous (5-merous)
خماسي الأجزاء :
وصف الزهرة التي يكون فيها عدد الأجزاء خمسة
في كل محيط .

Perianth
غلاف زهري :
الكأس أو التويج أو هما معا ، أو الأوراق المغلفة
للأعضاء الأساسية في الزهرة عندما تكون غير مميزة
إلى كأس وتويج .

Perigonium (= perigone)
غلاف زهري :
عندما يكون غير مميز إلى كأس وتويج .

Pilose
شعري ، مشعر :
وصف السطح المغطى بشعر ناعم .

Pinnate
ريشي :
وصف للورقة المركبة التي تترتب فيها الوريقات على
جانبي المحور .

Pinnatifid
ضحلة التفصص الريشي :
وصف الورقة المفصصة ريشيا التي يكون انقسام نصلها
غير غائر ولا يصل إلى منتصف المسافة بين الحافة
والعرق الوسطى .

Pinnatisect

مشرح التفصص الريشي :
وصف للورقة المفصصة ريشيا التي يصل تفصص نصلها
من العمق إلى قرب العرق الوسطى .

Pinnule

رويشة :

Pistillate

أنثوي :

Plicate

مطوي :
ذو أجزاء مطوية طوليا .

Plumose

ريشي الشكل :
على شكل الريشة التي تحمل زغبا رفيعا على جانبيها .

Polygamous

متعدد أنواع الزهرة :
وصف للنوع الذي يحمل أزهارا خنثوية وأخرى
وحيدة الجنس على نفس النبات .

Polymorphic

متعدد الأشكال :

Polypetalous

سائب البتلات :
وصف للتويج الذي يتكون من عدد من البتلات المنفصلة .

Polysepalous

سائب السبلات :
وصف للكأس الذي يتكون من عدد من السبلات
المنفصلة .

Prickle

شوكة :

Procumbent

زاحف :
وصف للساق التي تنمو زاحفة على سطح الأرض .

Proliferous

سريع التكاثر ـ مفرخ :
وصف للأوراق التي تحمل براعم للتكاثر ، وللنباتات
التي تنتج أفرادا أو أجزاء وفيرة بطريقة غير عادية .

Prostrate
زاحف :

Pruinose
شمعي :
مغطى بطبقة من الشمع أو مغبر بحبيبات بيضاء
أو قطيرات .

Pubescent
زغبي :
مغطى بشعر ناعم قصير .

Pulvinate
وسادي :
وصف لقاعدة الورقة عندما تكون منتفخة أكثر من
المعتاد .

Pulvinus
وسادة :

Punctate
منقط :

Pungent
شاك ـ لاذع :

Puperulent
مخملي :
مغطى بشعر قصير ناعم كالقطيفة .

Pustular
ذو بثرات :
وصف للسطح المنقط ببثرات صغيرة .

Pyrene (=pyrena)
بنيدقة في الحسلة :
مصطلح يطلق على بذرة الحسلة وما حولها من
غلاف حجري صلب ، كنواة المشمش والخوخ .

Pyriform
كمثري الشكل :

R

Raceme
عنقود :
نورة بسيطة غير محدودة فيها تكون الأزهار معنقة
ومحمولة على المحور الابتدائي مباشرة في تعاقب
قمي ، ويكون محور النورة طويلا .

Racemose

نورة غير محدودة :
النورة التي تترتب فيها الأزهار في تعاقب قمي بحيث تفتح البعيدة عن القمة (أو المركز) أولا .

Rachilla

محور زهري ثانوي :
ويطلق عادة على محور السنيبلة ، أي الذي يحمل الزهيرات ، في الفصيلة النجيلية .

Rachis

محور :
المحور الذي يحمل الأزهار في النورة أو الوريقات في الورقة المركبة .

Radical

جذري :
ينشأ فوق الجذر مباشرة ، كأوراق اللفت والفجل

Receptacle

تخت :

Reclinate

متدلي :
منحني إلى أسفل أو منثن للخلف .

Regular flower

زهرة منتظمة :
أي متعددة التناظر أي يمكن قسمتها إلى قسمين متماثلين في عدة مستويات .

Reniform

كلوي الشكل :

Repand

متموج :
وصف حافة الورقة إذا كانت ذات تضاريس غير منتظمة .

Resupinate

مقلوب :
وصف العضو أو الجزء النباتي الذي تتجه قمته إلى أسفل وقاعدته إلى أعلى .

Retrose

منحني إلى أسفل أو منثن للخلف :

Retuse — غائر ـ مشقوق :
وصف قمة الورقة إذا كانت بها ثلمة غائرة نوعا ، عريضة غير عميقة .

Revolute — ملتف :

Ringent — مفتوح الفم :
وصف للتويج المكون من شفتين بينهما تجويف كتجويف الفم .

Rostrate — منقاري ـ ذو منقار :

Rufrescent — ضارب إلى الحمرة :

Rugose — مجعد متغضن :
العضو الذي يكون سطحه متغضنا أو به خطوط ناتئة تفصلها أخاديد .

Ruminate — مبقع :
وصف للأجزاء التي يبدو قطاعها كالمبقع ـ وصف البذور التي تنثني فيها القصرة أو البرسبرم للداخل حتى تظهر في القطاع داخل الاندوسبرم .

Runcinate — حاد التسنن :
وصف الحافة المفصصة ذات الأسنان المنشارية الحادة المتجه تفصصها نحو القاعدة .

Rush-like — بوطي الشكل :
وصف لنباتات المستنقعات القصبية ذات السيقان القائمة التي تنبت أصولها في الماء وتعلو أفرعها في الهواء .

S

Saccate — ذو أكياس :

Sagittate — سهمي :

Salverform

صينية الشكل :
وصف للتويج الملتحم ذي الأنبوبة الضيقة التي
تتفلطح فجأة في أعلاها .

Samara

ثمرة جناحية :

Scabrous (=scabride)

خشن الملمس :
وصف السطح الذي يكون خشنا بسبب تغطيته
بشعور قوية أو بحراشف أو نتوءات .

Scape

حامل زهري عديم الأوراق :

Scapose

شمراخي :

Scarious

غشائي :

Schizocarp

ثمرة متشققة :

Scorpioid

عقربي :

Secund

وحيد الجانب :
وصف للأزهار أو الأوراق عندما تبدو كأنما خرجت
كلها على جانب واحد .

Semiverticillate

شبه سوارية ، شبه محيطية :
وصف الازهار أو الأوراق عندما تكون مرتبة حول المحور
فيا يشبه المحيطات أو السوارات

Sepaloid

سبلي :

Septicidal

حاجزي التفتح :
وصف الثمرة العلبية الجافة التي تتفتح على امتداد
الحواجز التي بين مساكنها .

Seriate

مصفوف ـ مسلسل :

Sericeous	حريري : مغطى بشعور ناعمة كالحرير .
Serrate	منشاري :
Serrulate	منيشيري : وصف حافة الورقة إذا كانت ذا نتوءات منشارية ولكنها صغيرة .
Setaceous	شوكي :
Setose	شوكي :
Setulose	شويكي :
Silicle	خريدلة : ثمرة عريضة قصيرة جافة متفتحة خاصة بالفصيلة الصليبية ذات مسكنين بينهما حاجز كاذب .
Siliqua	خردلة :
Spathulate	ملعقي :
Spicate	سنبلي :
Spiculate	شائك :
Spike	سنبلة :
Spikelet	سنيبلة :
Spur	مهماز : امتداد كيسي أو انبوبي الشكل من التويج أو الكأس .
Squamate	حرشفي :
Squamose (=squamous)	حرشفي :

Squamule — حرشفة :

Squamulose — صغير الحراشف :

Squarrose — حريشفي :

Staminate — سدائي :

Staminode — سداة عقيمة :

Stellate — نجمي :

Stipe — حامل :

Stipitate — معنق :

Stipulate — مؤذنة :

Stipule — أذينة :

Striate — مقلم ـ مخطط :

Strigose — شعري حاد :
وصف للسطح الذي يتغطى بشعور صلبة حادة منتفخة القاعدة .

Subtending — متأبط :

Subulate — مثقابي :
ضيق وأسطواني ومستدقي تدريجيا إلى قمة مدببة ، كورقة البصل .

Succulent — عصيري :

Suffrutescent — شجري أو شجيري :

Sulcate	محفور : ذو أخاديد طويلة تفصلها متون .
Superior	علوي : وصف المبيض في الزهرة تحت المتاعية حيث يكون في مستوى أعلى من مستوى المحيطات الخارجية .
Sympetalous	متحد البتلات :
Syncarpous	متحد الكرابل :
Syngenesious	ملتحم المتوك :

T

Terete	اسطواني :
Tetradynamous	رباعي الاسدية الطويلة : وصف للطلع المكون من أربع أسدية طويلة وسداتين قصيرتين كما في الفصيلة الصليبية .
Tomentose	زغبي كثيف : مغطى بشعر صوفي كثيف .
Tomentulose	زغيبي ، قصير الزغب :
Torulose	عقدي : وصف للعضو الذي ينتفخ انتفاخات غير منتظمة على مسافات متقاربة .
Triquetrous	ثلاثي الأركان ـ مثلث الأركان : وصف العضو الذي يكون قطاعه المستعرض مثلثا ، مع تقعر الأضلاع نوعا .
Truncate	مقطوع الطرف :

U

Umbel — خيمة :

Umbellate — خيمي :

Unciniate — خطافي :

Urceolate — قدري الشكل :
على شكل قدر .

Utricle — ثمرة مثانية :
ثمرة صغيرة وحيدة البذرة تشبه المثانة ، غير متفتحة ، ذات جدار غشائي .

V

Velutinous — مخملي :
مغطى بشعور قائمة ناعمة كالمخمل .

Veticillate (whorled) — محيطي - سواري :

Villous (=villose) — وبري :
وصف للسطح المغطى بشعر طويل ناعم .

W

Woolly — صوفي :
سطح مغطى بشعر طويل وكثيف كالصوف .

X

Xerophyte — نبات جفافي :

Z

Zygomorphic — وحيد التناظر :
وصف للزهرة التي لا يمكن قسمتها إلى نصفين متماثلين إلا في مستوى واحد فقط .

VERNACULAR NAMES

(Latin–Vernacular)

Latin	Vernacular	Arabic
Acacia ehrenbergiana	Salam	سلم
A. tortilis	Samr	سمر
Aeluropus lagopoides	Ikrish	عكرش
Aerva javonica	Tirf (Tuwaim)	طرف
Aizoon canariense	Gafnah	جفنة
Alhagi mauronum	Áaqool	عاقول
Ammi majus	Khillah	خلة
Anabasis setifera	Himd-Sha'aran	حمض - شعران
Anastatica hierochuntica	Kaff Maryam	كف مريم
Artemisia inculta	Shih	شيح
Arthrocnumem glaucum	Shnan	شنان
Asphodelus fistulosus	Barwaq-Barwag	بروق
Astragalus corrugatus	Halaq	حلق
A. eremophilus	Halaq	حلق
Atriplex leucoclada	Raghl	رغل
Avicennia marine	Girm	جرم
Beta vulgaris	Silq	سلق
Blepharis ciliavis	Shook el Dhab	شوك الضب
Capparis spinosa	Shafallah	شفلح
Cassia italica	Ishriq	عشرق

Cenchrus cillaris	**Sabat**	سبط
Centaurea sinaica	**Murrar**	مرير
Chloris virgata	**Khazamzam**	خزمزم
Chrysopogon aucheri	**Haltaa**	هلتأ
Cistanche phelypaea	**Dhonoon**	ذنون
Citrullus colocynthis	**Shary**	شري
Convolvulus arvensis	**Olleiq**	عليق
Cornulaca monacantha	**Thallag**	ثلج
Cressa cretica	**Nediwah**	نديوه
Cucumis prophetarum	**Shary-Hadaj**	شري
Cymbopogon parkeri	**Skhabar**	أصخبر
Cynodon dactylon	**Nejil-Najm-Thayiel**	نجيل
Cynomorium coccineum	**Tarthouth**	طرثوث
Cyperus conglomeratus	**Rasha**	رشاء
Dactyloctenium aegyptium	**Najm**	نجم
Dipcadi erythreum	**Misselmo**	مصيلمو
Eleusine compressa	**Sonneim**	صنيم
Emex spinosus	**Hinzab**	حنزاب
Erodeum laciniatum	**Himbaz**	حماز
Fagonia spp	**Shaga**	شجا
Filago desertorum	**Qutteinah**	قطينة

Francoeuria crispa	**Githgath Yithyath**	جثجاث
Frankenia pulverulenta	**Molleih**	مليح
Gastroctyle hispida	**Rims**	رمس
Glossonema edule	**Itr (Garawah)**	عتر (جراوة)
Halopeplis perfoliata	**Khorreiz**	خريز
Hammada elegans	**Rimth**	رمث
Helianthemum lippii	**Ragroug**	رقروق
Hippocrepis bicontorta	**Ummal Qurain**	أم القرين
Lasiurus hirsutus	**Da'ah**	ضعه
Launaea capitata	**Huwwah**	حوة
L. nudicaulis	**Huwwah**	حوة
Leptadenia pyrotechnica	**Markh**	مرخ
Limonium axillare	**Qataf**	قطف
Lycium shawii	**Awsaj**	عوسج
Malva parviflora	**Kobbeizah**	خبيزة
Medicago laciniata	**Nafal**	نفل
M. sativa	**Jatt**	جت
Neurada procumbens	**Seidan**	سعيدان
Panicum turgidum	**Thumam**	ثمام
Pennisetum divisum	**Thaymoum**	ثيموم

Polypogon monspliensis	**Dheil El Qott**	ذيل القط
Portulaca oleracea	**Barbir**	بربير
Rhanterium epapposum	**Arfaj**	عرفج
Rumex vesicarius	**Hommeid**	حميض
Salvia aegyptiaca	**Noaeim**	نعيم
Savignya parviflora	**Girgis**	جرجيس
Seidlitzia rosmarinus	**Shnan**	شنان
Setaria verticellata	**Losseiq**	لصيق
Solanum nigrum	**Enab ed Deeb**	عنب الديب
Stipa capensis	**Samáah**	صمعة
Suaeda vermiculata	**Suwweid**	سويد
Tamarix spp.	**Tarfah-Athl**	طرفة ـ أثل
Teucrium pollum	**Jaad, Yaa'd**	جعد
Typha domingensis	**Burdi**	بردي
Ziziphus nummularia	**Sidr**	سدر
Z. mauritianus	**Knar**	كنار
Zygophyllum quatarense	**Harm**	هرم

(Vernacular–Latin)

Tamarix spp.	أثل
Cymbopogon parkeri	أصخبر
Hippocrepis bicontorta	أم القرين

Portulaca oleracea	بر بير
Typha domingensis	بردى
Asphodelus fistulosus	بر وق
Cornulaca monacantha	ثلج
Panicum turgidum	ثمام
Pennisetum divisum	ثيموم
Medicago sativa	جت
Francoeuria crispa	جثجاث
Glossonema edule	جراوة
Savignya parviflora	جرجيس
Teucrium polium	جعد
Aizoon canariense	جفنة
Astragalus corrugatus, A. eremophilus	حلق
Erodium laciniatum	حمباز
Anabasis setifera	حمض
Rumex vesicarius	حميض
Emex spinosus	حنزاب
Launaea capitata, L. nudicaulis	حوة
Malva parviflora	خبيزة
Halopeplis perfoliata	خر يز
Chloris virgata	خزمزم
Ammi majus	خلة

Polypogon monspliensis ديل القط

Cistanche phelypaea ذنون

Cuperus conglomeratus رشاء

Atriplex leucoclada رغل

Helianthemum lippii رقروق

Hammada elegans رمث

Gastroctyle hispida رمس

Cenchrus ciliaris سبط

Ziziphus nummularia سدر

Neurada procumbens سعيدان

Beta vulgaris سلق

Acacia ehrenbergiana سلم

A. tortilis سمر

Suaeda vermiculata سويد

Fagonia spp. شجا

Citrullus colocynthis, Cucumis prophetarum شرى

Anabasis articulata شعران

Capparis spinosa شفلح

Arthrocnemum glaucum, Seidlitzia rosmarinus شنان

Blepharis ciliaris شوك الضب

Artemisia inculta شيح

Stipa capensis	صمعة
Eleusine compressa	صنيم
Lasiurus hirsutus	ضعه
Cynomorium coccineum	طرثوث
Aerva javonica	طرف
Tamarix spp.	طرفة
Alhagi maurorum	عاقول
Glossonema edule	عتر
Rhanterium epapposum	عرفج
Cassia italica	عشرق
Aeluropus lagopoides	عكرش
Colvolvulus arvensis	عليق
Solanum nigrum	عنب الديب
Lycium shawii	عوسج
Avicennia marina	قرم
Limonium axillare	قطف
Bassia eriophora	قطن
Filago desertorum	قطينة
Anastatica hierochuntica	كف مريم
Ziziphus mauritiana	كنار

Setaria verticellata	لصيق
Centaurea sinaica	مرار
Leptadenia pyrotechnica	مرخ
Dipcadi erythreum	مصيلمو
Arnebia hispidissima	مليح
Dactyloctenium aegyptium	نجم
Cynodon dactylon	نجيل
Cressa cretica	نديوه
Salvia aegyptiaca	نعيم
Medicago laciniata	نفل
Zygophyllum quatarense	هرم
Chrysopogon aucheri	هلتا

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